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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Second Annual Meeting, American Gas Institute.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Sept. 4, 1907.

To the Members, American Gas Institute: The second annual meeting of the American Gas Institute will be held at Washington, D. C., October 16, 17 and 18, and will be called to order by the President, Walton Clark, of Philadelphia. The New Willard Hotel has been chosen as headquarters, and the sessions will be held in the auditorium thereof. The Ins itute will be formally welcomed to Washington by the Honorable H. B. F. MacFarland, President of the Board of Commissioners, District of Columbia.

The following schedule of rates offered by various hotels in Washington are submitted:

		Without Bath — One Person. Single Room.	Without Bath — One Person. Double Room.	Without Bath — Two Persons. Double Room.	Without Bath — Two Persons. Extra Large Room.	With Bath — One Person. Single Room.	With Bath — One Person. Double Room.	With Bath — Two Persons. Double Room.	With Bath — Two Persons. Extra Large Room.
New Willard,	E	$2.50 up.	$3.00 up	....	$4.00 up.	$3.50 up.	$4.00 up.	$5.00 up.	$5.50 up.
Raleigh.....	E	2.00	3.00	4.00	4.00	3.00	4.00	4.00	6.00
		..	....	....	....	3.50		6.00	up.
Occidental.....	E	Suites, 2 bedrooms, Parlor and bath, $4 and $5							
Shoreham	E	2.00	3.00	4.00	5.00	3.00	4.00	5.00	7.00
	A	4.00	5.00	8.00	9.00	5.00	6.00	9.00	11.00
Arlington	E	2.00	....	4.00	4.00	3.00	...	5.00	5.00
	A	4.00	....	4.00	8.00	5.00	....	9.00	9.00
Normandie ...	E	1.50	2.00	2.00	2.50	2.00	3.00	4.00	4.00
	A	3.00	3.50	5.00	6.00	3.50	5.00	8.00	8.00
Riggs House..	A	3.00	3.50	6.00	7.00	4.00	5.00	8.00	10.00
Grafton	A	3.00	3.50	6.00	....	5.00	6.00	8.00	....
		....	5.00	8.00	....	....	....	9.00	....
Cochran.....	A	....	....	.. ..	....	....	4.00	7.00	....
Metropolitan..	E	1.00	2.00	2.00	3.00	2.00	2.50	4.00	6.00
		...	....	....	....	...	3.00	.	up
	A	2.50	3.00	5.00	6.00	3.50	4.00	7.00	8.00 up
Ebbitt	A	3.00	....	6.00	....	5.00	6.00	10.00	....
		4.00	....	up	....	....	....	....	....
St. James.....	E	1.00	2.50	3.00	....	2.50	3.00	4.00	....
		2.00	4.00	4.00	....	3.00	4.00	6.00	....
National.....	E	1.00	2.00	2.50	3.00	2.00	....	4.00	....
		..	....	....	.. ..	2.50	....	....	....
		2.50	3.00	5.00	6.00	3.50	....	7.00	....
		....	....	....	....	4.00	....	....	....
Howard House	E	2.00	....	2.00	6.00	....	....	....	....
		2.00	....	2.50	....	....	....	....	....

E—European Plan. A—American Plan.

The named papers have been secured by the President for presentation to the Institute, together with the reports of the following committees:

"Depreciation;" by Mr. A. C. Humphreys.

Communication from New England Association; by Its Committee on Uniform Accounting and Depreciation.

Report of Committee on Methods of Taking Candle Power; by Mr. Wm. H. Gartley, Chairman, Philadelphia, Pa.

Experience in Omaha on "Delivering Uniform Candle Power to Consumers;" by Mr. George H. Waring.

"The Obligations Imposed by the Possession of a Franchise;" by Mr. Chas. H. Dickey.

Report of Public Policy Committee; Mr. E. G. Cowdery, Chairman.

Report of Committee on Making of Rates and Additional System of Costs; Mr. W. H. Gardiner, Chairman.

Report of Committee on Economic Balance between Calorific Value and Candle Power; Mr. Thos. D. Miller, Chairman.

Report of Committee on Board of Revision; Mr. J. D. Shattuck, Chairman.

"Instructions for Operating Recuperative Benches;" by Mr. W. A. Baehr.

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"Experiments in Carbonization;" by Mr. W. H. Fulweiler.
Lecture on "Electrolysis;" by Prof. A F. Ganz.
Report of Committee on Electrolysis; Mr. A. G. Glasgow, Chairman.
Report of Committee on Pipe Standards; Mr. Walton Forstall, Chairman.
Experience with Dipping Meters; reports from Baltimore, by Mr. A. S. Miller. Also reports from Philadelphia and Savannah.
Report on "A" Meter Results from Philadelphia and Kansas City.
Report of Committee on Uniformity of Meters; Mr. Charles H. Dickey, Chairman.
"Air Blast Gas Appliances," by Messrs. W. K. Eavenson, Philip Cross and W. H. Allen.

The Passenger Associations will not consider rates on the certificate plan until after their next meeting, which convenes September 10th. Many State Legislatures having enacted the 2-cent rate, the Commissioner of the Trunk Line Association writes as follows:

143 Liberty St., N. Y., July 25th, 1907.

Mr. Jas. W. Dunbar, Sec. American Gas Institute, New Albany, Ind.:

Dear Sir—Referring to your letter of the 15th, beg to advise that, on account of the unsettled rate conditions, the Trunk Lines feel they cannot consider the question of reduced fares for meetings or conventions to be held after the month of September, until their next meeting, which will convene on September 10th, after which we will promptly communicate to you decision reached respecting your application. Yours truly,

(Signed) L. P. Barnes, Commissioner.

The Secretary will be pleased to mail applications to those who may wish to become members of the Institute. Further detailed information in reference to the convention will be forthcoming.

Yours truly, James W. Dunbar, Secretary.

[Official Notice.]

Change of Meeting Place, Michigan Gas Association.

Michigan Gas Association,
Office of Secretary,
Detroit, Mich., July 1, 1907.

To the Members, Michigan Gas Association: Owing to unavoidable delays in the completion of the new hotel at Kalamazoo, Mich., the Executive Committee has changed the place of meeting from Kalamazoo to Battle Creek, the meeting to be held September 18, 19 and 20, 1907. A notice will be sent in the near future giving full information in regard to hotels and programme, for papers as well as entertainment. Respectfully, Alonzo P. Ewing, Secretary.

[Notice.]

Fifteenth Meeting, Pacific Coast Gas Association.

Pacific Coast Gas Association,
Office of the Secretary,
San Francisco, Cal., Aug. 17, 1907.

To the Members of the Pacific Coast Gas Association: As the date[1] of our fifteenth convention is drawing near, I take this means of notifying you of the following arrangements that have been made, in order that you can make your plans accordingly:

Railroad Rates.—The Southern Pacific Railroad Company has named a special rate of full fare and a third, from all points in California to Santa Cruz and return. Instructions have been issued to their Agents to put this rate into effect 10 days prior to the meeting, and the same will remain in force 48 hours after adjournment of the convention on Thursday, September 19th; in other words, up to the Saturday night following the close of the meeting. At the time of purchasing your tickets you should notify the Agent that you are to attend the Association meeting, and at that time you will be furnished with a receipt certificate, which certificate will have to be countersigned by the Secretary of the Association or his representative in in order to secure your return ticket from Santa Cruz. You should buy your ticket for one way only, and for which you will be required to pay full rate, but your return ticket, after the receipt certificate has been countersigned by the Secretary of the Association, will be furnished you at one-third of the regular fare. The above arrangement will also apply to tickets purchased at Reno, Nev., by members of the Association as outlined.

Papers.—While I am not prepared at the present writing to advise you of the titles of the various papers to be presented before the convention, still they will be up to the usual standard and no doubt bring forth discussions of much merit; suffice it to say that all who attend the coming convention will return to their "camping ground, wiser and better men," for all those who visit beautiful Santa Cruz never have an idle moment, and if they do 'tis their own fault.

I am inclosing you herewith postal card, which you will kindly fill out and return at the earliest possible moment, in order that accommodations can be reserved at once, as simultaneously with the convention there will be a big automobile meet, and this, with all the other attractions, will tend to draw a greater crowd than usual.

Make your arrangements at once, and give your wife, children and sweethearts something to look forward to by getting in line for the banner meeting of the Association. Don't fail to advise me promptly of your intentions. Yours very truly, John A. Britton, Sec'y.

1. The Convention will be called to order Tuesday, the 17th.

BRIEFLY TOLD.

Battle Creek Meeting of the Michigan Gas Association.—We had every reason for believing that in this issue of the Journal we would print the details respecting the sixteenth annual meeting of the Michigan Gas Association: but Secretary Ewing either overlooked us or else the preparing of the precise programme was unavoidably delayed. However, enough is known to us unofficially regarding the details to enable us to declare that the meeting is bound to compare, for importance and value, more than evenly with any of the preceding conventions. Certainly, this would seem loud enough acclaim for the worth and enjoyability of the Battle Creek sessions next week. President Dewey likely will have something to say in the instance of some of the measures inimical to the gas interests of the State that were debated last winter and spring in the legislative halls at Lansing. And this leads up to the statement that, if the founders of the Michigan Gas Association had no other cause for taking credit to themselves for such founding than that which it has so far achieved in the instance of turning harassing State intervention into beneficial protection for both Company and consumer, their congratulation should be hearty and prolonged. To repeat, unofficial advices are to the surety that the Battle Creek sessions will be fruitful of good.

The Public Service Commission and the "Testing" of Meters in New York State.—When the Hearst emotionalists and the bugle-blowers in the Republican and Democratic parties in this State rose in "their might" and passed the measures relating to gas manufacture and distribution that were to guide the Public Service Commission in its relation thereto, a provision of the raw mess named law, in as far as gas and electric meters are concerned, was this: "No corporation or person shall furnish or put in use any gas meter which shall not have been inspected, proved and sealed, or any electric meters which shall not have been inspected, approved, stamped or marked by an inspector of the Commission." Well, Chairman Stevens of the Commission has been investigating the meat of the command, and it seems that the longer he studies it the stronger he is convinced of the inutility of the law, in that it is "too drastic" in the first place, and "too impossible" in the second place. However, he has had the good sense to take into his councils the meter makers themselves, and they have gone to the point of advising that the meters could, as far as they were directly concerned, be as well tested at the distributing stations as at the factories—this applies, of course, to gas meters rather than to electric meters. Regarding the latter, it may be fairly remarked that, intricate and voluminous as the Commission's gas meter troubles may be, those that the electric meters will involve them in are sure to be more involute and perplexing. In fact, it looks that the gas men are in easy position to name chapter and verse for what they have to uphold and prove, whereas the electric men apparently are short of a completed alphabet for their book. From all points, however, the course to pursue is that of counciling and moderation, since insensate legislative acts are the more easily proved unsound when their dissection is made in a manner that is devoid of fever and fraught with mechanics; for, surely, whether a gas meter is fast or slow is easily shown by a simple mechanical operation.

CURRENT COMMENT.—

It seems that Mr. Burdette Loomis and his legal relative, Mr. Hawley Pettibone, are interested in the project for the construction of the proposed gas works for Waycross, Ga. As is well known, Mr. Loomis has had some connection with the gas business in this country, notably in Bridgeport, Conn.

The tests, as carried out under the ordinances of Omaha, Neb., respecting the candle power and heating quality of the gas supplied by the local Company, show that in both respects the Company is well above the conditions prescribed. During the month of August Commissioner Crowley made 17 tests on the score of heating value, all of which show a fair excess over the stipulation.

The Peoples Gas Light and Coke Company, of Chicago, has secured a dissolution of the injunction restraining it from constructing a gas-holder and retaining tank therefor at the corner of 64th street and Grove avenue. The Company has added largely, and wisely, to its real estate holdings in the vicinity named.

[Prepared for the JOURNAL.]

Classification of Distribution Work.

By MR. WALTON FORSTALL.

The American Gas Institute will, at its coming meeting, receive a communication from the New England Gas Association on the subject of the urgent necessity of embodying into the "Uniform System of Accounts" (called hereafter Accounts) adopted by the American Gas Light Association in 1902, proper provision for depreciation. Every gas company called to argue before legislature or commission against rate reduction has suffered grievously because, in support of its reasonable plea for a depreciation allowance in getting burner cost, it has not been able to point to depreciation funds as being set aside in practice or even recommended in theory by any classification of accounts that has the theoretical approval (even if not always adopted) of gas associations.

There is every reason to believe that, in the coming year, the Institute will change the accounts, not only to care for depreciation, but also in any other particulars that 5 years' experience may have suggested to the users. Just how many companies have adopted the accounts is unkown. Probably, except for some of the larger syndicates, the accounts have had no effect on gas company bookkeeping. This means that, in New York and Wisconsin, the new State Commissions have found no unanimity in practice and, unless exceptionally well advised, each Commission will adopt its own system of accounts. What a serious handicap to syndicate management and, as affecting comparison of costs, to the advance of the industry itself, will be the existence of as many systems of accounts as there are State Commissions can readily be imagined. The only possible means of avoiding such an outcome is for the companies, through the Institute, to devise a system satisfactory to all and to put it into practice. Some idea of how much at sea the gas profession seems to be on the question of accounts is shown in the discussion at the last meeting of the Empire State Gas and Electric Association. This discussion also showed how the Street Railway Association, by adopting and putting into use, about 10 years ago, a uniform system of accounts, had been put in a position to obtain the approval of this system by the National Government and the late New York Railroad Commission.

The writer believes that the accounts are worthy of universal adoption, but desires to discuss certain minor changes that he believes could be profitably made. The subject is taken up at this time in the hope that the points brought out may be criticised and data accumulated for the benefit of the Institute.

One of the reasons for any division of expenses is to furnish unit costs. From these, by an analysis of the work done and also by a comparison with costs obtained under the most available similar conditions, springs the pressure and incentive to more and more economical working. It is from the standpoint of a useful tool in reducing costs that the accounts will now be discussed, divisions A and E only being considered.

It is probably safe to say that 10 years ago the only unit costs the average gas man cared for were expressed in cents per 1,000, with the possible exception of the cost per foot of main laying and of service work. The cost of connecting a gas range might be looked up from time to time when considering a new business campaign. Any accurate record of it, however, from month to month as a spur to cheaper work, was unheard of. These and any other appliance costs with the increasing amounts spent in gratuitous work for the consumer, were expressed in cents per 1,000, known only to the man who did the figuring and to the responsible officials of the company, and, even if known to the employees who did the work, were not expressed in the right terms to let them know what they were doing.

Again, in the old days the idea was that the big companies could do such and such, but the average gas company was a one or two-man concern and there was no time to find out what was being done. At present, with the rapid growth of cities and with syndicate management, big companies are becoming the rule. In a large organization there is a splendid opportunity, by keeping unit costs as between superintendents or foremen, to encourage brains and industry to get definite knowledge of the value of such men. With a small company the comparison may be made between the individual men. Of course, in the former case, where the comparison is between various overseers of work, each of these overseers, in order to have any chance to survive as one of the fittest, must on his own behalf begin to compare his workmen. Such comparison, however, usually does not have to take the form of written costs, because the overseer is in near enough touch with his own men to know their qualities of speed and efficiency.

In view of the foregoing, it is assumed that every manager or superintendent should be furnished by the accounting department with unit costs of all the various classes of his work. Experience has shown in all lines of business that a prompt knowledge of working costs, where the units are properly chosen and where each foreman or workman is furnished with not only his own costs but those of the other men doing the same work, always results in increasing economies, whether or not a bonus is paid.

Turning now to the Accounts, Senior Classification, we find that "B. Distribution Account," is subdivided into seven accounts, which will be discussed one by one.

B 1.—*Complaint Expense.*—With two exceptions the items chargeable to this account agree with the definition and embrace a fairly homogeneous class of work. This account will furnish each month a unit cost per order attended to, which, as in the case of all other costs referred to, should be divided between labor and material, material being considered as all charges not shown on pay roll. The two items which do not belong in the account and which, if included, interfere with any proper unit cost, are "Pumping Street Main Drips," and "Taking Pressures in Mains." These two items were put into "Complaint Expense" because there did not seem to be any other place to put them, and it was thought unwise to increase the number of accounts. The first item should be put under "Repairs Mains" where the company is not large enough to open a "Street Pressure Expense." The second item will, as a rule, warrant a "Drip Expense." There was hardly any work where a greater percentage of saving was possible than in drip pumping as formerly done by any company. The last decade has seen great improvement in this respect, but the best results are not obtained until costs per drip and gallon pumped are regularly kept. One of the requisites for accuracy in these as well as any other costs is a separate account. Any attempt to pick drip costs out of "Complaint Expense" or "Repairs Mains" is sure to lead to more or less inaccuracy. For very small companies, who do not see enough possible saving to warrant a separate account, the item should go to "Repairs Mains."

B 2.—*Distribution Office Expense.*—This account, of necessity, is a collection of odds and ends, and unit costs are not obtainable from it as a whole; but a monthly division of the total number of orders handled by the distribution department, into the payroll charges to this account, gives a cost per order passing through the office, which will be valuable in promoting economy, both as between several offices and in encouraging one office to strive for a lower figure each month.

B 3.—*Gratuitous Work.*—As it stands this account is valuable in showing the total net amount spent on work, the entire cost of which may justly be charged to the consumer, and should be done at a loss only so long as the price received for gas warrants a practical reduction in price in the form of such gratuitous services, or as the outlay is repaid through increased sales. From the standpoint of unit costs, however, the account should be divided and all appliance work; viz., everything that has not to do with lighting, put into "Gas Appliance Expense." With these two accounts, the total amount and cost per order are obtained for the lighting and also the fuel (and heating) divisions of the business. The total fuel costs are quite important in arriving at a just idea of the money earning value of any definite policy of installing and maintaining fuel appliances.

B 4.—*Repairs Mains.*—This account is not one that lends itself easily to unit costs, and, therefore, it was designated as the dumping ground of the two items taken out of "Service Expense." As all permanent main laying is charged to other accounts, the charges against "Repairs Mains" are not apt to be heavy, except "Searching for and Repairing Leaks in Mains." Where the company is very large "Overhauling Expenses" should be opened and this can readily be subdivided by sizes to 4–0, 6–0, 8–0, etc. In a small company, if much repair work is done in any month, a separate account of the expense should be kept, and a cost given per "joint" uncovered.

B 5.—*Repairs Services.*—This account was made to include all work to the end of the meter connection, stopping where "Complaint Expense" begins. Probably in most companies service work, both new and repairs, as done by the service men, extends only to the inside of the house wall, any work from that point to the meter being done by the same men who do meter work. Therefore, the items "Renewing, Enlarging or Repairing Meter Connections" and "Renewing or Repairing Meter Shelves" should be thrown into "Setting

and Removing Meters," if, as is almost universally the case, the work is done when a meter is being replaced. Otherwise the charge should be to "Complaint Expense," to which also the item "House Governors" should be transferred. With these three items out of the way "Repairs Services" relates entirely to the work of the service men, and a unit cost per foot of service repaired should be given as divided between labor, material and sundries (remainder of cost).

B 6.—*Repairs Meters.*—This account is quite clear cut and furnishes a unit cost per meter repaired, which usually is subdivided as between sizes and two or three classes of repairs.

B 7.—*Setting and Removing Meters.*—This account should, for the large companies, be subdivided by putting "Turning On Gas" and "Turning Off Gas" into "Turn On and Off Expense." Thus is furnished a cost per meter handled and also a cost per turn on and off. The difference between these two costs has an appreciable effect on the extent to which meters should be left in empty houses. One cost for both classes of work would not mean much.

B 8.—*Street Mains Abandoned.*—An account for the Secretary, not for the Superintendent.

E.—*New Business Account.*—This is subdivided into six accounts, of which the first three will not be considered, because not falling within the scope of distribution work.

E 4.—*Gas Appliances.*—This account gives a unit cost per appliance connected and will meet the needs of all companies, except in large cities, where there is a field for the use of gas in many industrial operations. If such is the case, the account should be subdivided, "Special Appliances," being opened to care for all installations of appliances, which are not the household type of range or water heater.

E 5.—*Gas Engine Expense.*—This account shows the expense due to gas engines, both installation and maintenance. If much business were done in this line, two accounts would be needed, one to give connection, the other maintenance costs. The general practice, however, is to charge cost for all connections, and then the net balance of the account simply indicates the cost of complaint work.

E 6.—*House Fitting Expense.*—This covers several classes of work, and in large cities the items relating to the inspection of house piping ought to be put into "House Pipe Inspection." This will enable the exact cost of such work to be known and give a unit cost per inspection made. In this account also comes the complete piping of old houses. When much of this is done, there might be an argument for a separate account, except that the need for such work is fast disappearing and separate labor costs certainly are easily kept for each house.

To summarize, the "Senior Classification of the Accounts" should, in addition to a few transfers of items, be enlarged by the addition of the following accounts, the fractional number being used to indicate the account of which it is a subdivision:

Distribution Account.	*New Business Account.*
B 3½.—Gas Appliance expense.	E 4½.—Special appliances.
B 4½.—Street pressure expense.	E 6½.—House pipe inspection.
B 4½.—Drip expense.	
B 4¾.—Overhauling expense.	
B 7½.—Turn on and off expense.	

[Prepared for the JOURNAL.]

Contrivances for Hoisting Gas Pipes.

By "ENGINEER."

Contrivances for hoisting and lowering gas pipes are among the useful devices of the modern equipped plant, for pipes are larger, longer and oftentimes heavier than they formerly were. They are like the American steel rails for steam and electrical power roads, which rails have been increasing in length year by year, until at the present time they are double the length they were 25 years ago. With the increase in length and general proportions of pipes and fixtures for conveying illuminating gas from one point to another, a demand has sprung up for apparatus to accomplish the lifting, lowering and moving to the best advantage. Pipes have to be placed on flat cars for transportation; pipes are moved up and down in storage departments; pipes are lowered to positions in excavations, and hauled up for repairs, etc. Hence in this article reference will be made to some of the systems employed by various engineers for the handling of gas pipes with ease and facility. In addition to the handling of gas pipes allowances have to be made for various other parts of a gas outfit. There are drums, retorts, cylinders, tubes, etc., all of which must be arranged for in the complete equipment for lashing and elevating or lowering the devices connected with gas making and gas distribution and use. You should, first of all, put in some clamps. Clamps are useful for adjusting binders for the ropes or chains at different available points along a circular surface, such as a pipe or gas retort is. The clamps may be circular to conform to the shapes of the pipes or drums, or they may be square.

Wrought iron clamping stock is always reliable and useful; still, the square clamps may be made of hard wood, and bored at the ends for the fastening bolts. You want a number of pieces of old canvas, carpeting, felt or kindred material at hand, so that when you lash a pipe or circular surface of any kind without the clamps, the surface will be protected. I have seen excellent pipe and drum surfaces seriously marred by workmen lashing up with chains. The chains are stronger, but when used should be furnished with special fittings to protect the surfaces of the object handled. I have seen defective ropes used and break. Not long since when visiting a plant where they were loading some heavy sections of gas pipe, the rope broke off, as shown at *A*, Fig. 1. In this case the plan involved the use of the scaffold device, constructed of timber. A block and tackle were adjusted to a supporting hook, as shown at *B*; the hauling rope is marked *C*. I happened to be looking that way when an unusually heavy section of iron gas pipe was well elevated in the air for purposes of loading on a flat car. The rope snapped as the crane swung, letting the pipe strike, flange down, on the stone cobbles below, smashing the flange to pieces and ruining the pipe; but the workmen seemed to regard it as a matter of course. They replaced the rope with another one of the same size, which by-the-way was an old one. Then they proceeded to load the broken pipe onto the car just the same, chucking it in without remark. No doubt upon arrival at destination the car company would get the benefit of the broken pipe, and perhaps have to pay for it on the supposition that it had been broken by rough handling in transit.

At another plant where gas pipes and gas retorts were in process of loading, I noticed that the procedure consisted in binding up a retort as in Fig. 2. The rope is wound about the center of the drum a number of times, and the wooden wedges are driven in. The wedges not only tighten the rope but serve to protect the surfaces of the drum. As a rule, however, the tough, riveted plate surfaces of these drums do not require very complete protection. If you can get the thing bound up so that the lifting apparatus will hold fast to the end you are doing enough. Accidents are many, which seems strange; but after speaking with foremen and others on the subject, I concluded that it was best to stand from under when these devices are being lifted. Often the proper balance is not maintained, due to securing the rope too far forward or backward, or the hitch is not positive and opens, letting the thing drop. Sometimes there is a flaw in the rope. I saw a retort seriously damaged through dropping 30 feet and striking on the wheel of a heavy truck, and examination revealed a flaw in the new rope. Claim of damage was made against the party selling the rope, but nothing came of it, because it was stated that the users of the rope should have inspected it and discovered the defect.

I notice that in some places they use compressed air lifts of the description shown in Fig. 3. Only short distances can be made with these lifts, as the piston rod *E* has to be the entire length of the cylinder *D*. The platform is made of planks, properly cleated and bolted, and the guide rods, *C*, *C*, are braced in bearings top and bottom and these guide the platform in the trip up and down. As the platform is elevated by the pressure of compressed air on the head of the plates in the cylinder, and is supported thereupon, there is no danger of a fall unless the air supply gives out. This device is used for lifting pipes and gas drums short distances for loading, storing, or other purposes.

In Fig. 4 is shown one of the home-made clamping contrivances for getting ho'd of the pipe. The object is to have two of these clamps on the pipe, with rings, *F*, on each, which rings catch into the lifting ropes or chains of the lifting device. The clamp is made of the two end pieces of hard wood, usually two by four stock for large pipes, and inch bolts, properly threaded and provided with the fastening nuts, *G*, *G*. It is a good idea to have a set of these clamps of various sizes at hand for immediate use.

In one establishment where the writer called he noticed that a system of net lifts was used. The nets were made of strong cords, terminating at the top in a metal ring. This ring serves for a medium to join on to a hook. The nets for the heavy work are constructed of

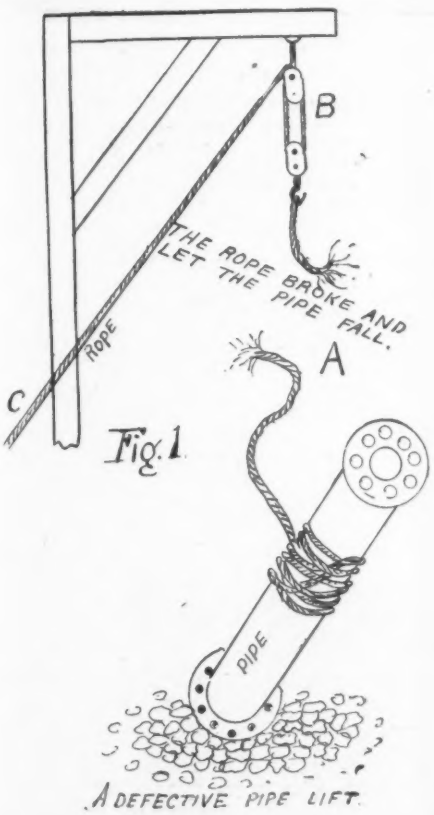


Fig. 1.

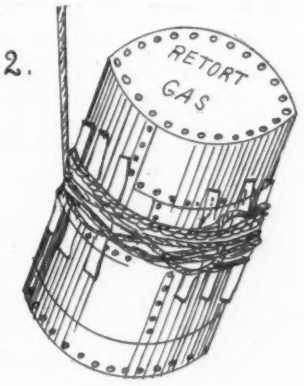


Fig. 2.

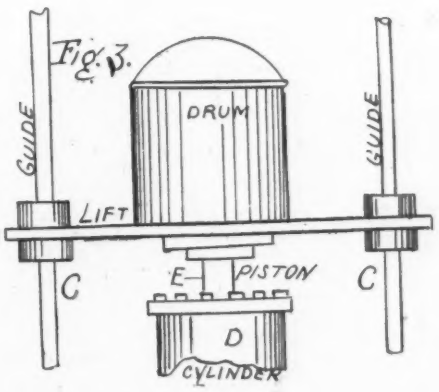


Fig. 3.

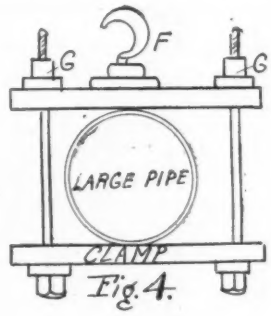


Fig. 4.

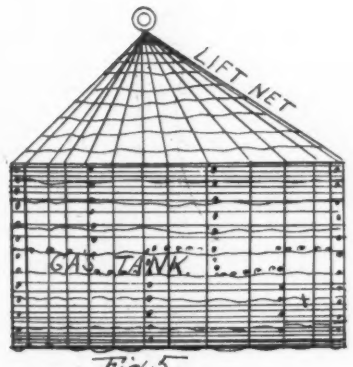


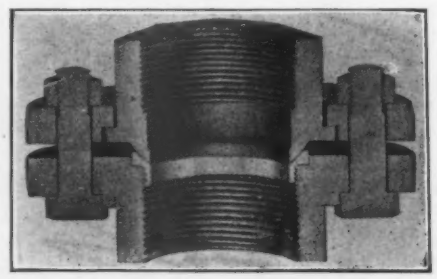
Fig. 5.

material closely resembling common clothes line, and the smaller nets for piecer of small pipes are made of lighter stock. The net can be employed to some advantage in lifting articles like drums, certain forms of pipes and supplies. There is no danger of abrading the articles with binding ropes and chains or wedges. Of course precaution has to be taken not to put in pointed articles that might impregnate the sides. The lift net is useful for throwing in a number of small pieces for transportion to a certain point. The meshes of the net must, of course, be smaller than the articles.

If you visit some of the piping plants you will get occasional starts and shocks at specimens of the procedures. I saw one man rolling costly piping down a plank incline. Everytime a section of pipe struck another section at the bottom of the run, and sparks and pieces of metal flew, he expressed great glee. Finally a boss came along and obliged him to let each pipe down the incline with a rope.

The Kewanee Flange Union.

The Western Tube Company is putting on the market a flange union without gasket for simplifying the assembling of pipe lines with flange joints. It also compensates for imperfect alignment. The seating is after the manner of a ball joint, as shown in the accompanying illustration, so that the effect of spring in the pipe or crooked threads is



corrected. Another feature contributing to convenience in its use is that it has one flange movable, so that the annoyance of matching the holes for the bolts is entirely done away with. The parts, of which there are four exclusive of the bolts, are the solid flange, the loose flange and its associated nipple and the seat. The latter is brass and is screwed into the solid flange. All of the other parts are malleable iron.

The seat in the brass is concave and that on the nipple convex, and both are arcs of circles of the same radius, so that considerable deviation in the alignment of the coupled parts is permissible. The flanges being made of malleable iron are in no danger of being broken when the joint is pulled together, or later when the line is under pressure, and the junction of a hard and soft metal at the seat insures a perfect contact, which it is claimed will remain so. By avoiding the use of a gasket a large amount of labor is saved which is required with ordinary unions in the cutting and fitting of gaskets. The Company claims to have found by experiment that the extra time taken to cut and fit a rubber gasket and the value of the rubber packing used, together, involve an expense that is more than the difference in price between an ordinary union and the Kewanee union.

It is particularly pointed out that the union is a compact one and very light in weight for its strength and rigidity. The unions before they are shipped are submitted to an air pressure test under water and are rejected if not absolutely tight. They are made in all of the standard sizes from 1 to 10 inches and in either black or galvanized finish.

A 40,000-Volt Power Transmission In Lombardia.[1]

One of the most interesting high tension, 3-phase power transmission in Europe, of recent construction, is that utilizing the hydraulic power available at the upper part of the Serio river. This mountain stream rises in the "Monti Orobii," discharging into the Adda river after flowing about 100 kilometers through the Seriana Valley.

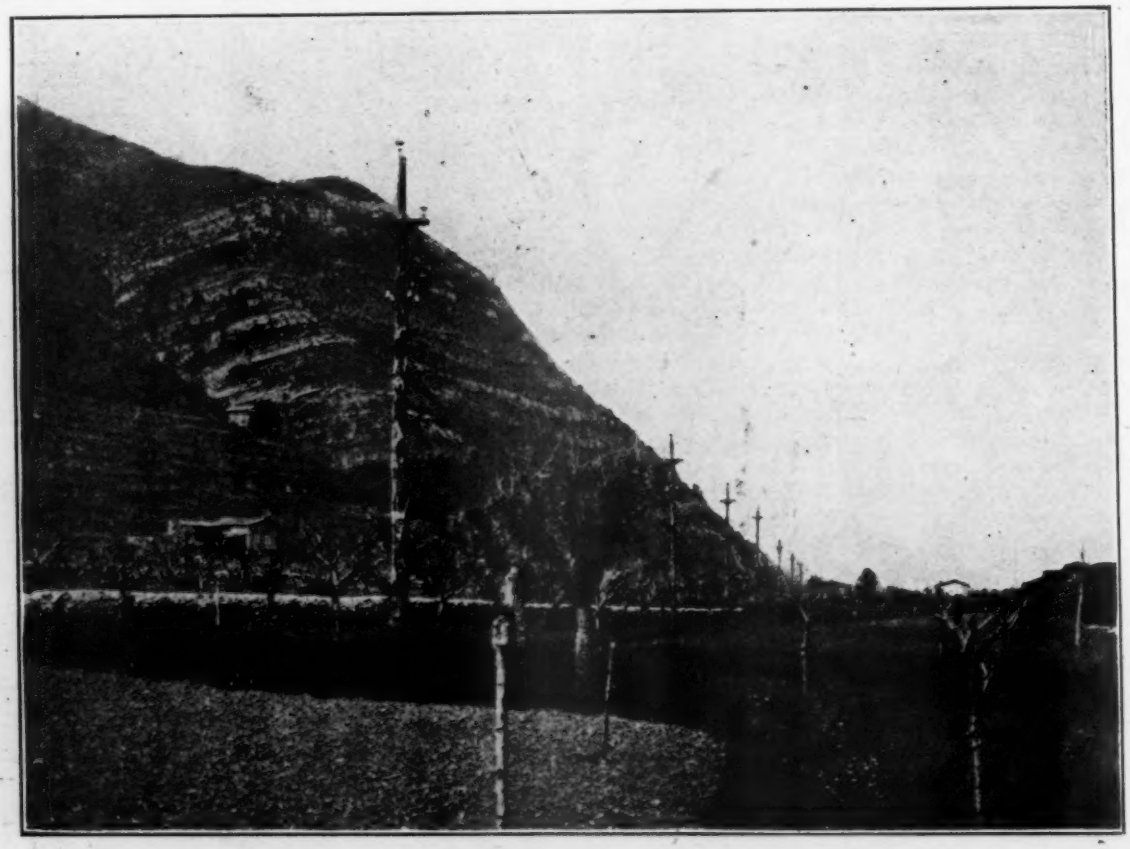
It was decided by the European engineers to take advantage of two waterfalls, each capable of supplying 2,000-horse power in utilizing and developing the water power of the "Val Seriana," one of these being located at Gromo, and the other some distance further up.

The accompanying illustrations show the hydraulic and electrical equipment at the Gromo plant, the 40,000-volt power transmission line conducting the current a distance of 35 kilometers to Nembro, and the transforming and sub-station apparatus for distributing the power to the spinning mills and other industries in that section of Lombardia.

The power house is equipped with three turbines of 1,000-horse power, each constructed by Escher, Wyss & Co., of Zurich, Switzerland, these turbines being directly connected to the electrical generator by Zodel couplings. There are also two smaller turbines directly coupled to direct current dynamos of 25 kilowatts each, for supplying exciting current to the fields of the alternators.

Each electrical generator supplies current directly to the primary winding of a step-up transformer of 850-kilovolt amperes. The high

1. *Electricity, Power and Gas.*



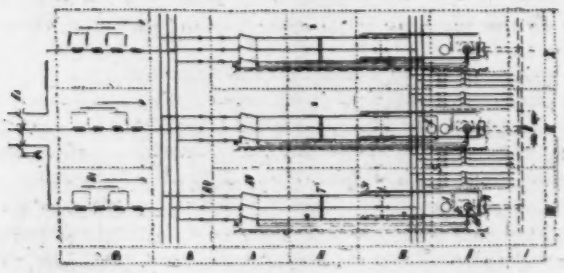
Curve of Gromo Power Transmission Line at the Del Rio Bridge.

tension current at 40,000 volts is conducted from the secondary terminals of the transformer of each unit to the high tension busbars for parallel operation with the other units, and the paralleling is thus accomplished by special switches in the high voltage transformer circuits.

The electrical equipment was installed by Brown, Boveri & Co., of Baden, Switzerland, and these Swiss engineers term this method of grouping the three units, a hydro-electric transformer set. The turbine, in connection with the generator and transformer, is operated in this manner at the 20,000-volt Como hydro-electric plant, and they consider this an epoch in central station service of this character.

These Swiss engineers hold that by cutting out the busbars between the transformers and the generators, only one-half of the controlling and measuring instruments and devices are required. It is stated that from the 4,000-volt side, the current and tension transformers are energized for the overload relays of the automatic switches, as well as for the ammeters and volt meters. The volt meters and ampere meters indicate simultaneously the tension, as well as the current, when it is remembered that the ratio of the transformer is as 1:10, and by paralell running, also, the phase difference of both the 40,000-volt and 4,000-volt circuit, a cheaper construction of transformer also being allowable by this lower voltage.

It is maintained that perfect isolation of each group is possible, as the generating set is provided with disconnecting links between the busbars and the high tension switches for 40,000 volts. By means of a special device the high tension oil switch can be released electrically or mechanically by hand, or by a double pole overload relay, which is fed by a current transformer branched on the 4,000-volt side. From the busbars there is only one feeder line, and it is stated that no fuses are used in the exciter circuits while the current is taken from the exciter busbars for the tripping coils of the high tension oil switches.



Electrical Connection of Transformers at Sub-Station.

The transformation ratio of the transformer is from 4,000 to 40,000 volts, and the efficiency is 97.8 per cent. on non-inductive loads. The current has a frequency of 50 periods per second, and the transformer apparatus is tested to 67,000 volts between the secondary and primary. These transformers of 850 K. V. A. are 2.18 meters high, and occupy a floor space of 1.6 meters by 1.36 meters. The step-up transformers are of the water cooled, oil insulated type, about 18 liters of water being used per minute, of 18 Centigrade, for cooling. Soft iron yokes are utilized for holding together the three vertical parts of the transformer, the coils being wound in the form of concentric cylinders. A very high grade and heavy insulating partition is used for separating the primary and secondary windings, the high tension coils being so interwoven that there is only 300 volts difference of potential between each sub-division.

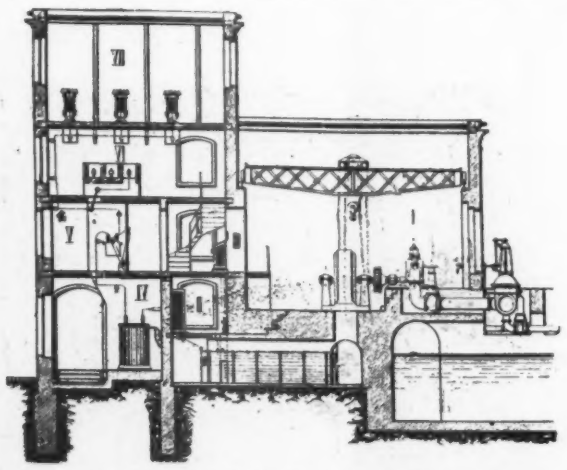
The 3-phase alternators are of the horizontal shaft construction, with revolving fields and stationary armatures with star connected windings. These 3-phase alternating generators are of the 12-pole type, and supply a current having a frequency of 50 cycles per second, and a pressure of 4,000 volts, when operated at a speed of 500 revolutions per minute.

On a power factor of .80, the normal output is about 1,000-horse power, and the efficiency at this load is 93 per cent., including the losses of excitation. When the generator is operated at half load the efficiency is 90 per cent. and the drop in voltage is said to be 70 per cent. on a power factor of unity from no load to full load, and 20 per cent. on a power factor of .80. These alternators weigh about 13 kilograms per horse power output, or a total of about 26,000 pounds.

The exciter dynamos have an efficiency of 88.5 per cent. at half load, and 90 per cent. at full load, a slotted drum armature being employed and a cast steel dynamo frame with 6 poles of soft iron laminations. These direct current dynamos are driven at a speed of 800 revolutions per minute, and generate a current of 217 amperes at a pressure of 115 volts, each set developing about 25 kilowatts.

One of the most interesting features of this power transmission is the switchboard transmission line and step-down transforming apparatus.

The accompanying diagrams and illustrations show the connections and construction of this high tension switch gear and transforming apparatus. At Gromo the switchboard apparatus is installed in a



Gromo 40,000-Volt Hydro-Electric Power Plant.

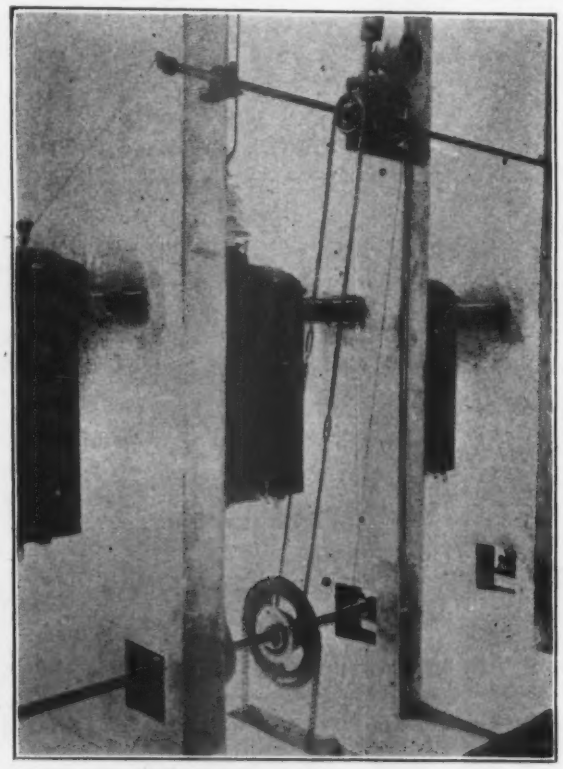
separate building from the main turbine and generator room, each of the three floors provided occupying a space of 10 by 7 meters, the basement of the switch house being divided into two parts, one of which is 2.7 meters above the main generator room, and the other 1.2 meters below the main floor level, and containing the regulating rheostats and the transformers.

There are also two rooms in the first floor of the switch house, one of which forms a sort of gallery overlooking the turbine and generator room, this part being equipped with the measuring instruments, switch levers and controlling wheels of the main operating switchboard.

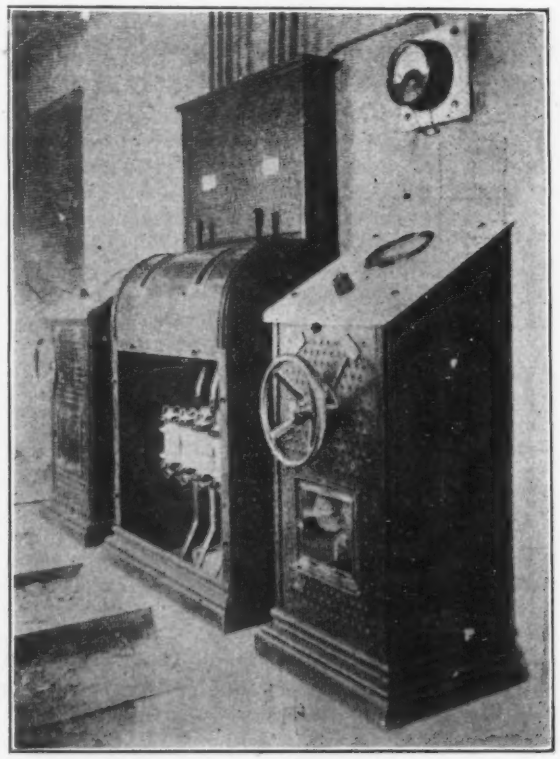
The other room of the first story contains the high tension automatic switches and the three transformers.

The lightning arresters and outgoing conductors and connections are installed on the third floor. Specially constructed insulators are provided for use on the 40,000-volt leads in this power station, as shown in the accompanying figures. There are two current transformers and one potential transformer, also three high tension, single pole tube fuses, with blowout horn carried on the framework of each generator. A riveted iron structure is utilized for this framework, embossed sheeting being used for covering the lateral side, with removable shields in front for examining or renewing the fuses. Glass tubes are cemented into the dividing wall, through which the leads enter the transformer room. Each phase of the 40,000-volt busbar apparatus has inclosed separate cells of fireproof material, the walls being 120 millimeters in thickness. The insulators are tested to 100,000 volts, and the high tension oil switches are located on the first floor, below the high tension busbar, a separate switch being utilized for each phase, all of which being so arranged as to work together. A common driving spindle is provided for these automatic high tension switches, two of which belong to the 3-pole switch of an hydro electric transforming set, as it is called, and the other to the 3-pole switches of the leads. The fireproof cells in which the switches are installed are 600 millimeters wide, and the connections pass through the top through an opening from the switches to the busbars. By means of a rotating motion the switch is operated from the distant main board by a hand wheel, multiple break switches being employed, an oil bath submerging the stationary as well as the moving contact. When it is desired to get at the electrical contacts, the oil cases may be lowered out of the way without difficulty.

The high tension transmission line from the Gromo power house to the Nembro sub-station is 32 kilometers long, and follows along the banks of the Serio river. The power is utilized for driving the cotton machinery of Crespi & Co., of Milan, and the power transmission line to Nembro is capable of carrying 4,000-horse power. With this amount of power the drop will not exceed 5 per cent., it is stated, the



Driving Spindle for the Switches at the Gromo Power Plant.



Switchboard for the Primary and Secondary Transformer Side and for the 50°-Volt Feeders.

line consisting of 3 bare copper conductors mounted on Delta insulators, the wires having a diameter of 6.5 millimeters.

The longest span on this transmission line is 120 meters and the sharpest angle is 145°, the transmission line to Nembro crossing a canal and another power transmission line at Albino, as well as a single phase line of 2,000 volts at San Carlo.

At the Nembro sub-station the 3-phase current enters from the Gromo hydro-electric station at a pressure of 38,000 volts. Provision is made for 3 stepdown transformers, 2 having been already installed of 500 K.V.A.. with a ratio of transformation of 38,000/500 volts.

These stepdown transformers are the same oil insulated, water cooled type used at the Gromo hydro-electric plant, and they have an efficiency of 97.6 per cent. on non-inductive full load. The regulation on a power factor of .70 was found to be 2.8 per cent., and the inherent regulation was found to be .8 per cent. on non-inductive full load.

These stepdown transformers take 13 liters of water per minute for cooling for each unit, and they occupy a space 2,005 millimeters high, 1,155 millimeters wide, and 1.6 meters in length. The switching apparatus and the electrical connections at the Nembro sub-station a e similar to those at the Gromo power house, and therefore a detailed

description would be superfluous. In this transformer station there are two stories and a basement, the ground floor being divided into two compartments, in one of which the transformers are installed. The high tension, automatic switches are mounted on the next floor above the transformer, and in the front room there are two desk panels for the high tension switches; also a 500-volt distributing feeder panel. The high tension busbars of 38,000 volts are practically the same as those at Gromo, and lightning arresters, also of the same construction, are located in the next compartment. This power transmission plant is said to be giving most excellent satisfaction, and is very economical in operation.

The Fuel Testing Plant of the United States Geological Survey at the Jamestown Exposition.

A contemporary remarks that the fuel testing work of the United States Geological Survey should be followed with close interest by all engineers, not only because it is important to all fuel consumers, but because this branch of the Government work is undertaken to point out new paths for the development of the natural resources of the country by locating, classifying and testing all kinds of available fuel.

Accurately compiled results of the more recent work of this branch will soon be published, and the following particulars of the plant at the Jamestown Exposition will doubtless be of interest.

Fig. 1. shows the plan of the Power and Alcohol Building in the grounds of the Jamestown Exposition, indicating the location of the boilers, gas producers and engines, nearly all of which apparatus was used at the St. Louis Exposition by the Geological Survey in conducting somewhat similar tests.

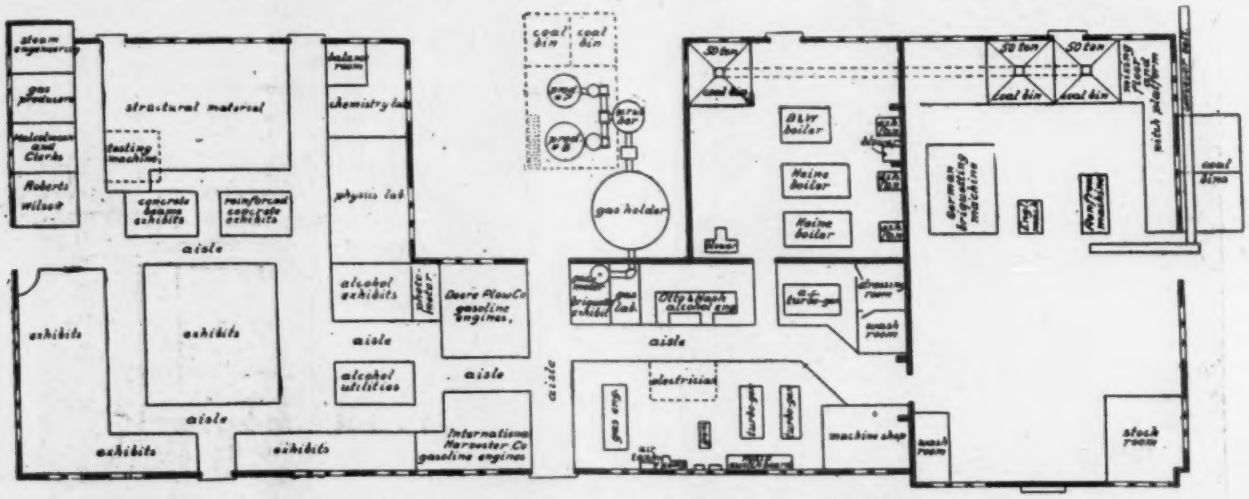


Fig. 1.—Plan View of Fuel Testing Plant at the Jamestown Exposition.

Steam Engineering Division.—New apparatus has been added to this division as follows: A 250-horse power Babcock & Wilcox boiler, with superheater, provided with a Roney stoker (Fig. 2); a Jones underfeed stoker with fan, added to one of the old Heine boilers; two direct current De Laval turbine sets (Fig. 3) rated 300-horse power at 9,000,900 revolutions; also three Green Fuel Economizer Company's induced draft fans.

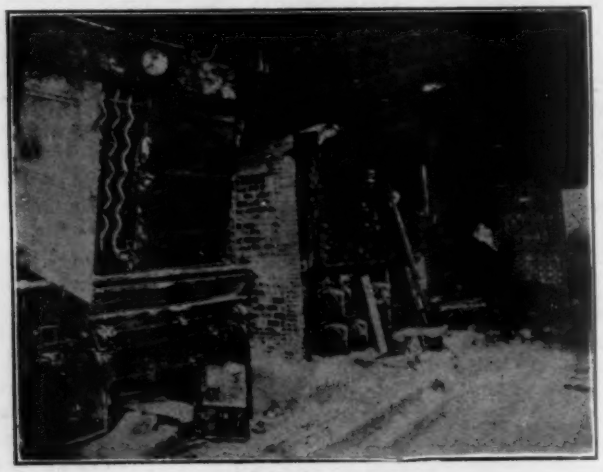


Fig. 2.—Interior of Boiler House.

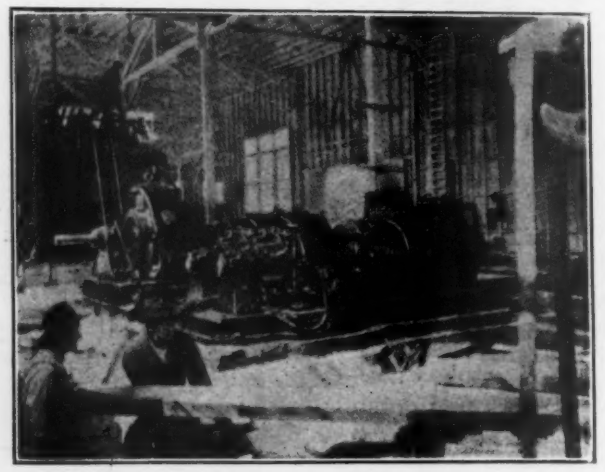


Fig. 3.—DeLaval Turbo-Generator Sets.

The method of work planned for this section is to be slightly changed, so that instead of testing a great number of coals, more tests will be made of the same coal, different sizes and different methods of stoking or feeding, etc., being employed with the object of determining the most economical performance under different rates of combustion and the best ratios of grate and heating surfaces.

The B. & W. boiler will be placed beside the two Heine boilers which have been brought from St. Louis, all three having been provided with induced draft apparatus in order to get a wide range of capacity. The Heine boiler provided with the Jones stoker has the usual arrangement for forced draft. The B. & W. boiler was inserted partly to enable tests to be made of the same fuel with different types of boilers. It serves to represent the types employing a perpendicular flow of the gases through the tubes, the parallel flow types being represented by the Heine boilers. The Heine boilers have been rebaffled or partitioned in such manner as to practically double their length by compelling all the heated gases to pass along the entire length of the tubes twice.

An additional alternating-current turbo-generator set may be installed as indicated to supply power for external and exhibition purposes.

The steam engineering division, which has now practically succeeded in isolating the performance of the boiler from that of the combined performance of the boiler and furnace, will carry on further tests with the object of still further determining the performance and efficiency of the furnace alone.

Producer Gas Section.—The apparatus in the producer gas section is arranged as shown in Fig. 1 and Fig. 6; the producer gas immediately on entering the building, passing through the meter and thence to the Westinghouse gas engine, shown in Fig. 4, transferred from

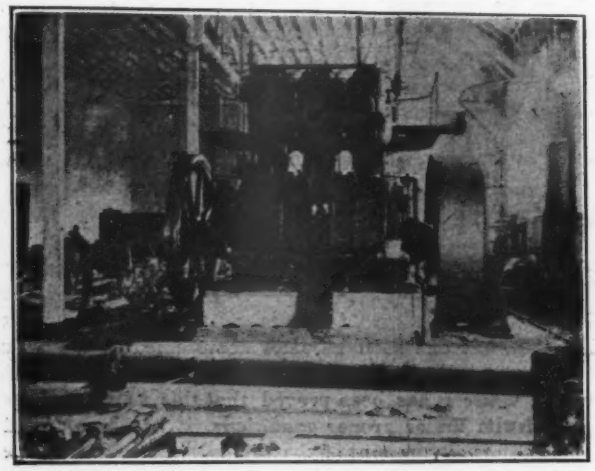


Fig. 4.—225-Horse Power Gas Engine.

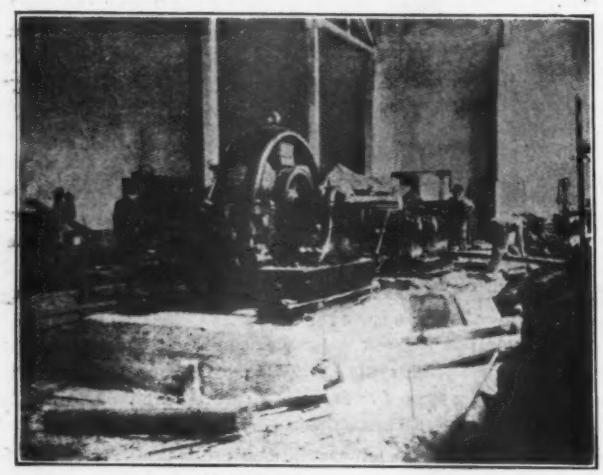


Fig. 5.—Generator Driven by Gas Engine.

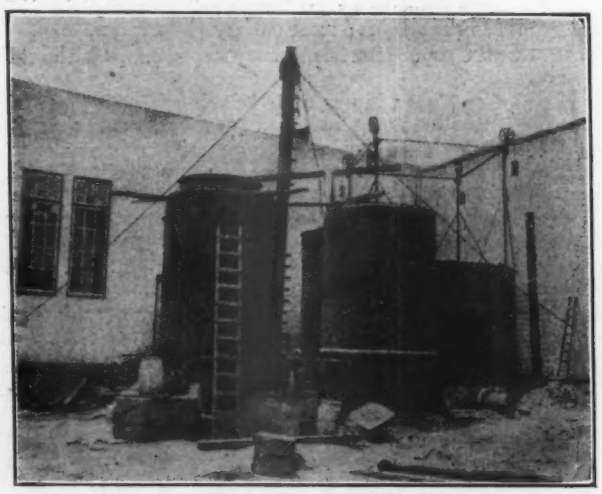


Fig. 6.—Gas Producer Plant.

the St. Louis plant. Some slight changes have been made in this apparatus. For instance, producer No. 7 has been provided with a water seal at the base to permit the ashes to be removed without admitting air, and several holes have been bored at different heights to be used for extracting samples of the gas. The purifying apparatus used at St. Louis has been removed (this, it will be remembered, consisted of the usual chamber containing iron filing and wood shavings), since experience indicates that the danger from impurities has been considerably exaggerated.

A special steam pipe has been provided to insure a steady water pressure, since the pressure of the supply mains fluctuates considerably.

The gas engine is belted to a 200-kw. Bullock generator, brought from St. Louis, which serves to drive the motors for the apparatus in the building, the machine shop, the briquette plant, the elevators and the conveyor. Any additional load required is obtained by means of a water rheostat, which can be regulated by the switchboard attendant so as to maintain a steady full load value.

The plans of this section include the following determinations: The proper length for a test run, the effect of the size of the coal, the best depth of fuel bed, the effects of rapid load variations, the maximum returns from different fuels, and the response of a producer plant to sudden demands for power.

Alcohol and Gasoline Engines.—A new work of great importance is being undertaken by this section. Its equipment includes two 15-horse power, 250 r. p. m. Otto gas engines; two 15-horse power Nash Company's engines; one 2-horse power International Harvester Company's engine, and two John Deere engines rated at 14 and 18-horse power, respectively.

Experiments will be made covering the whole range of this field, but for the present the work will be confined chiefly to examinations of different carburetters with the object of showing the lines along which a more efficient method of vaporization may be obtained. The other more prominent work is the examination of the kinds of fuels available, with special reference to gasoline versus alcohol, and an investigation of the use of kerosene as fuel for this class of engine, an investigation necessitated by the increasing demand for gasoline and the limited supply available.

Distillation of Coal and Combustion.—The study of the destructive distillation of the coal and its combustion in gas producers, coke ovens and furnaces, especially from the standpoint of physical chemistry, will be undertaken by several divisions.

Briquetting Division.—The briquetting division, which occupies the large room at the end of the building, is putting down one additional German briquetting machine, while the previous apparatus of English and American manufacture, that was used at St. Louis, is installed in the same room. The work of this division will be chiefly the manufacture of briquettes from various run-of-mine coals of the Eastern fields, which will be tested on war vessels under the direction of the steam engineering division.

Other Plans.—The further fuel testing work of the Geological Survey includes tests dealing with the spontaneous combustion of the stored coals, in which an effort will be made to simplify the methods for its prevention; while a corps of specialists will be detailed to investigate closely the whole subject of explosions in coal mines with a view to eliminating danger from this source.

Schoolhouse Illumination.

[Read by Mr. B. B. Hatch at a Meeting of the New England Section, Illuminating Engineering Society.]

In presenting this paper on schoolhouse illumination, the author wishes to state that what is herein contained is intended only as an outline of the principal requirements of schoolhouse illumination as at present understood and a description of some of the present methods and the objectionable features encountered in their use.

As to the requirements: The schoolhouse department of the city of Boston, on its organization in 1901, very promptly took steps to improve both the natural and artificial illumination of school rooms, and after some experimental work, decided that artificial illumination, by what I shall designate as the indirect method, was most satisfactory and proceeded to install this system in all the new buildings and in such old ones as it became necessary to renovate. Comparatively few complaints were received at first, due probably in part to the fact that none of the new buildings was used for evening sessions, and in part to a desire to give the system a fair trial. Of late, however, complaints have been numerous and undoubtedly justified for reasons which I will give a little later. It is at this point that the author's connection with the matter begins, and quite naturally the first efforts have been directed toward the establishment of a definite standard of illumination or some definite agreement with the school authorities as to the exact requirements.

It might be added that this has so far been a most difficult question to solve, on account of the diversity of opinion among those most interested, practically all being agreed that none of the present systems is ideal, although the old form of open cluster seems to have the most friends.

It is the author's opinion, however, that the requirements of classroom illumination may be stated briefly as such an arrangement of light sources that every desk will receive an illumination well defined as to direction, which should be from the left, yet so diffused that there will be no strong shadows, the minor shadows, of which there

are bound to be some, to fall to the right of and below any opaque object, such as a pencil or book held in the hand on a plane with the top of the desk. How near we can come to an actual realization of these conditions remains to be determined, but experiments are now being made along this line, the results of which will be reported later.

There is one very important factor entering into this proposition, and that is the factor of reflection from the side walls. We meet with two difficulties here, one of which is easily overcome, while the other presents a very difficult problem.

The first difficulty is in the tinting of the side walls. As an illustration, we have had during the past winter many complaints from a certain schoolhouse where the side walls have recently been painted a very dark green, while the woodwork is stained Flemish oak, which is practically black, and this is in addition to the blackboards which extend to a height of about 6 feet above the floor on three sides of the room. The ceilings are cream white and the form of illumination is five 3-lamp open clusters with 18-inch flat opal shades. This form of illumination has been in use 3 years and prior to the application of the dark green paint was considered satisfactory to the school authorities. One or two rooms still remain with the old color—which is buff—and are not objected to. In contrast with this building we have another where the walls have been recently tinted a very light green, and this room with six indirect clusters, each having lamps of 48 aggregate candle power, is much more satisfactory than the one with open clusters first referred to. Other rooms in the same building painted several shades darker and having the same illumination, have been frequently complained of. Another new building, with dark walls and indirect lighting, is a constant source of complaint.

In speaking of the treatment of the side walls, mention has been made of the treatment of three walls. We now come to the fourth or window side of the wall and our greatest difficulty. The schoolhouse department requires that daylight illumination shall be provided in the proportion of 1 square foot of window to every 5 square feet of floor area, the head of the window being square and close to the ceiling. This uses up practically all of the side wall on this side of the room, leaving only the window shades from which to obtain any benefit in reflecting artificial light.

As the windows are invariably on the left hand side, you will readily see our predicament. It may be asked why not make the window shades of light colored material, and have them drawn whenever the artificial lighting is used. This can be done in the new buildings where all the air for ventilation is admitted by modern methods, but it is impractical in most of the old buildings where the windows must be opened to admit air. It is also a fact that it is impractical to depend on having the shades drawn. Some teachers will do it, but many will not.

This matter of side wall coloring not only has a direct bearing on the candle foot illumination and direction of the shadows at the desk but has a very bad physical or optical effect on the students, many of whom have been obliged to leave the evening schools on account of eye troubles which opticians ascribe to the bad color effects. These complaints have been most numerous from the building first referred to and have resulted in the appointment by the school committee of a commission of five members, three of whom are opticians and two electricians, to investigate and report on the best methods of illumination, both natural and artificial.

There is reason to believe that the findings of this commission will be of great assistance to us. At any rate, it cannot fail to bring us nearer to something definite in the way of a standard requirement, which is, after all, the keynote to the whole situation.

For the information of those who are not familiar with schoolhouse work, I will state that a standard primary class room has up to the present been 24 feet by 30 feet, or 720 square feet total area. A grammar school room 26 feet by 32 feet, or 832 square feet. All rooms 13 feet in clear height.

The school committee has recently reduced the number of pupils to the room and in the buildings hereafter erected, the class rooms will be 2 or 3 feet smaller each way on the floor and about 12 feet 6 inches in the clear.

Since 1891 practically all class rooms have been lighted by the indirect method. Prior to that time, open clusters were in use. As so much has been said pro and con regarding this fixture, a description may be of interest. It consists of an under shade of opal glass, 18 inches in diameter by 6 inches in depth. Inside this shade are 4 incandescent lamps, set in porcelain sockets, at an angle of about 30° from the horizontal. A cover plate of clear plate glass resting in a spun metal ring, attached to the outer edge of the opal shade, serves to exclude dust from the lamps and the inside of the opal under shade. Ventilation is provided by several holes in a small canopy surrounding stem of the fixture near the glass cover.

This fixture is designed to project a greater part of the light against the ceiling and side walls, from whence it is thrown toward the floor in the form of diffused light, the direct light from the opal under shade being of some assistance to the illumination, yet not of sufficient intensity as to be disagreeable to the eye. Six of these fixtures, each equipped with lamps of 48 aggregate candle power, have been found capable of giving a standard grammar school room a very fair illumination, provided the side walls were correctly tinted and the fixtures in proper condition. To the casual observer, on first entering one of these rooms, the impression is given that there is not enough light, but one soon becomes accustomed to it and usually forms a better opinion of the system on more extended acquaintance.

However, while it has been proved that this fixture is capable of excellent results under proper conditions, it has been found practically worthless on account of the difficulty of realizing these conditions, the difficulty being to keep the fixtures, ceilings and side walls in the condition to get the best results. In most cases where complaint has been made, we have found the cover glasses thickly covered with dust. The cleaning of these glasses was in turn found to be a much more serious matter than at first anticipated from the fact that the glasses seldom fit closely into the supporting rings, consequently dust works into the under shade whenever the glass is cleaned. This necessitates cleaning out the under shade with a damp cloth, an awkward operation, requiring considerable time. Having this feature in mind, the janitors are naturally reluctant to use the special duster provided for the purpose, and the illumination suffers accordingly. Some thought has been given to the idea of making this fixture dust tight, but the idea has been abandoned on account of other difficulties. I have found this fixture very useful in hospitals, having had several in use for over a year.

In January of the present year we made a few experiments with different types of illuminants as a sort of preliminary step or guide in the selection of a type for further investigation. The results obtained were as follows:

1. Four No. 66 B. Welsbach gas burners, consuming 5 cubic feet of gas each, and partially inclosed in an opal shade so that the light was partially direct and partially indirect.

2. Four 4-ampere alternating arc lamps with concentric diffusing shades and opal lower shades; total energy 1,760 watts.

3. Two 275-watt Cooper-Hewitt mercury vapor lamps without shades or reflectors.

4. Four 4-glower Nernst lamps with 8-inch alabaster ball shades. Lamps burned in upright or inverted position; total energy 1,408 watts, or 86 watts per glower.

5. Four standard indirect schoolhouse clusters equipped with four 16-candle power lamps each; total energy 800 watts.

6. Four ordinary open clusters equipped with four 16-candle power lamps each, and flat porcelain shades; total energy 800 watts.

7. Six standard indirect schoolhouse clusters, equipped with four 8-candle power lamps each; total energy 672 watts.

8. Six General Electric, 125-watt "Gem" lamps, each equipped with a holophane deep bowl shade of prismatic glass; total energy 750 watts.

The illumination obtained on the desks in the various rooms of East Boston high school was as follows:

Gas	1.7 candle feet.
Arcs	1.7 "
Mercury vapor	4.0 to ¼ "
Nernst	2.0 "
Standard indirect cluster, 16-candle power	1.0 "
Open cluster, 16-candle power	1.7 "
Standard indirect cluster, 8-candle power	0.5 "
Gem, 125-watt	3.0 "

From the foregoing it will be seen that the best results have been obtained from the Nernst and "Gem" lamps, and further exepriments are now being carried on with these illuminants in conjunction with various types of fixtures and shades, the final outcome of which will be made known as soon as definitely arrived at.

Discussion.

Mr. H. T. Sands—Were the "Gem" lamps placed directly on the ceiling?

Mr. Hatch—The length of the pendant was about 30 inches, and it was about 10 feet above the floor.

Mr. N. W. Gifford—Did you arrive at any conclusion as to the proper amount of illumination that should be on the desks?

Mr. Hatch—I am not prepared to state the amount. That is one of the things I am very anxious to have a standard set upon.

Mr. W. B. King—How long are the pendants of the standard clusters?

Mr. Hatch—Thirty inches. In fact we took down 6 standard clusters and put "Gem" lamps in their places.

Mr. John Campbell—I would like to ask Dr. Williams if he has had any experience with injured eyesight of school children which he attributes to poor light in school rooms?

Dr. C. H. Williams—I cannot say offhand as to artificial light, but we do find this: Of course the bulk of these children are attending school by daylight, and in buildings where the light is poor we have a greater number who are troubled with their eyes than we do where the daylight is good. No doubt the same would apply to artificial light. It is also very important that more attention be given to the tinting of the walls. You may have the best possible system of lighting in the rooms, but if the walls absorb all the light instead of reflecting it, you will lose much of the effectiveness of the light. The walls should be of some light tint—anything that is just a little off white, light green, light buff, etc. The main point is to have the color light and not dark. It seems to me it will be an improvement in schoolroom lighting to have what may be called white blackboards, made of white marble slabs instead of slate, and finished with such a surface that blue, green or brown chalk will write on it easily and can be properly erased. Mr. Hatch says that he gets so many foot candles on the desks. How did he measure that?

Mr. Hatch—By the use of one of Dr. Williams's photographic wedges. In regard to this tint question, the schoolhouse department has been innocently led into the use of dark tints. It has come about through the desire to make the schoolrooms attractive, There has been a good deal of argument pro and con about the unsightliness of schoolrooms, and on the advice of the Civic Art League, which has kindly made a study of the question, the Schoolhouse Department has adopted these tints which are now so much in question. I am not sure that the tint I described first was one of those first recommended, but it is in line with nearly all of the recommendations.

Mr. F. Elwood Smith—In the placing of these "Gem" lamps on the ceiling, were they placed symmetrically or were they more on the window side of the room?

Mr. Hatch—They were placed not exactly symmetrically. The distance from the lamps to the side walls is about 6 feet 6 inches. The distance from lamp to lamp is about 14 feet.

Mr. Smith—In that way would you not get more light from the left than from the right?

Mr. Hatch—No; we should get some help in reflection from the side walls. The efficient angle of these shades is about 45° or 50° from the vertical, which strikes the side walls at a point nearly down to the top of the blackboard, but we want the light higher up against the side walls.

Mr. Campbell—What experimental work has been done, if any, in regard to the lighting of blackboards, or has such lighting come in incidentally?

Mr. Hatch—There has been no attempt to light the blackboards exclusively, except in the English High School. For some reason there are two or three rooms in this building where the blackboards are lighted with reflectors, much the same as you would light a show window. Whether it was because the color treatment was so bad I do not know. The rooms are really smaller than the regular class room. It was probably the idea of some individual.

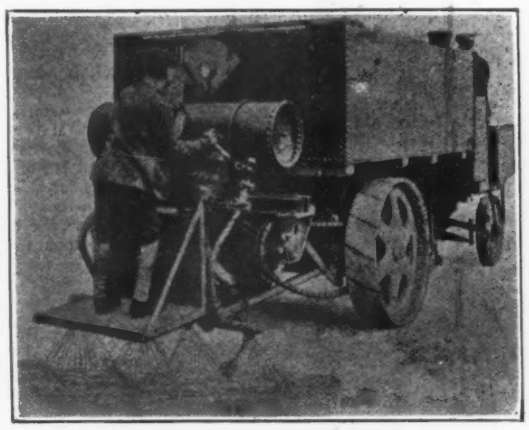
Mr. Sands—What would be the effect of sand blasting that bowl on the general diffusion of the light?

Mr. J. S. Codman—The effect of sand blasting a holophane bowl reflector is to diminish the intrinsic brilliancy of the bowl and make it soft and pleasing to the eye. At the same time it affects the distribution of the light. These bowl reflectors are so designed that the maximum candle power comes about 40° from the vertical, and this distribution is somewhat modified by the sand blasting, so that the vertical candle power is raised and the 40° candle power is reduced. In other words, there is an undesirable effect on the distribution. It is expected, however, to be able, by still further increasing the candle power at 40 by means of a new design, to get the present distribution when the reflector is sand blasted.

Tar for Roads.[1]

The Judges Committee appointed by the Roads Improvement Association (Incorporated) to carry out competitions for the best tar spreading machine and the best preparation of tar for road purposes have now made their awards.

The first prize of 100 guineas and the Association's gold medal for the best tar spreading machine goes to Mr. Thomas Aitken, M.Inst. C.E., County Buildings, Cupar-Fife, surveyor for the Cupar district of the county of Fife. Recognizing that material of a viscous nature, such as coal tar, is the most suitable for rendering macadamized roads waterproof, and for improving the wearing quality and eliminating dust and mud, Mr. Aitken has experimented in this direction for some years past. Distilled or refined tar, owing to its viscosity, is difficult of application in its ordinary state, and, consequently, it hitherto has had to be heated to make it sufficiently liquid to be readily spread with brooms. The heating of the tar and its distribution by pails and brushes, or similar methods, add considerably to the cost of the operations, and in many instances this expenditure is prohibitive. Considering that economy in carrying out such work is of the greatest importance, Mr. Aitken designed a pneumatic spraying apparatus which can discharge distilled tar in a hot or cold state, or other viscous liquid in a highly diffused state and at considerable pressure in the surface of macadamized roads.



Aitken's Pneumatic Tar Sprayer.

This patent spraying apparatus can be attached to an ordinary horse water cart or a water van drawn by a tractor. The best results, however, are obtained by using steam wagons, which have a large tank capacity and ample power to drive the mechanism and ascend steep gradients. The surface treated may vary from 4½ feet to 7½ feet in width at one operation, but 6 feet, being generally a multiple of the total width of road, is more satisfactory; distributing pipes projecting beyond the vehicle are considered inconvenient and dangerous. The apparatus has, besides the necessary arrangements for pumping air and tar, an air receiver fixed in an intermediate position—namely, between the tank containing the tar and the distributing pipe or spraying or atomizing nozzles. This arrangement insures a regular and equal distribution of the tar and that at a constant and high pressure delivery of over 200 pounds per square inch. In the first instance air is pumped into the receiver until the pressure gauge registers fully 100 pounds, and this remains constant at all times. The air valve is then closed and tar is pumped into the receiver until a pressure of from 150 pounds to 225 pounds per square inch is reached, depending on the temperature of the atmosphere. The spraying apparatus is then ready for work, and when in operation the valve admitting the tar into the receiver is regulated according to the quantity sprayed on to the road. Only two men are required to manipulate the machine. Mr. Aitken further writes:

In repairing macadamized roads by re-coating the full width and in long stretches, tar is made use of as a matrix along with a small proportion of whin chips and dust, instead of employing earthly matter and water as a binding in consolidating the metalling.

The road metal, after being spread to the required depth, is sprayed by means of the apparatus. Two or more applications are necessary in order to insure that the surfaces of all the stones composing the coating will be covered by a film of tar, about 6 gallons of tar being allowed to each ton of metalling used. Winstone chippings and dust or similar material are then spread over the surface, in varying but limited quantities depending on the gauge of the road stones, and then consolidated by rolling. The road is finished by again spraying the surface, and small chips and dust are added and completed by further rolling. No sweeping is required, as in water consolidated rolling, and the expenses of this item, along with the costs, in many instances, of binding and water, are saved. Two or three men making good irregularities, when necessary, and spreading the chips and dust, constitute the working staff, with, of course, one man attending to the spraying apparatus.

The cost of this system of executing the work, when tar is obtained at 3 cents per gallon, amounts to about 12 cents per ton of metal consolidated over the ordinary method, or 2 cents to 3 cents per square yard, according to the depth to which the metalling is spread, and, consequently, the amount of tar used. The surface of a road thus treated presents an asphaltic-like appearance, is thoroughly waterproof, and is characterized by absence of dust in dry weather, and by absence of mud in wet weather.

The life of a road made as described will be considerably prolonged, and the additional initial cost amply repaid. It is necessary to use refined tar, that the road stones be thoroughly dry, and the tarring be carried out in fine weather.

1. *Gas World.*

Tar possesses powerful disinfectant properties. It gives the road an impervious coating, and eliminates internal friction or rubbing of the stones one on another under traffic. This prevents interstitial wear and the formation of that dust in the crust of a road which is inseparable from a road consolidated by the ordinary methods. The noise of wheel traffic is deadened, vibration reduced, and surface disintegration under abnormal conditions of weather is avoided. When roads are repaired or re-coated, and are impervious to water as described, they can be formed with less contour or rise in center than is possible, from economical considerations, under existing methods—a matter of considerable importance to those using the highways, and especially to those travelling by motor car.

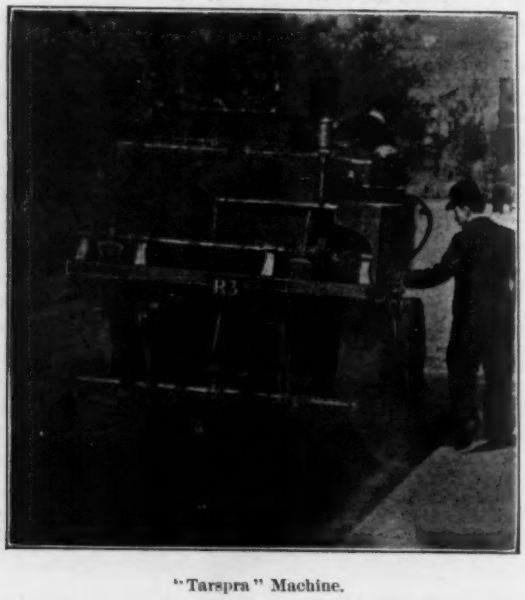
The apparatus is also admirably suited for spraying tar on and into the surface of existing macadamized roads. The road surface must be thoroughly cleaned of dust and foreign matter. It is then sprayed, one-half width of road at a time, with 1 gallon of tar to 5 to 9 square yards, according to requirements. The surface is then dusted over, if necessary, with the material previously removed, if clean and suitable, or by the application of sand or small chips and dust.

The cost of treating a road surface amounts to about ½ cent to 1 cent per square yard, depending on the quantity of tar used, and a slight additional cost for cleaning and for dusting over the surface when necessary. The extent of penetration depends on the description and quality of binding used when the metalling was consolidated, the temperature at the time of application, and the quantity of tar made use of when spraying.

A thoroughly dry road and fine weather when applying the tar are essential to successful work.

The quality of the tar is an important factor in this class of work. Tar insufficiently distilled is unsuitable, and in many instances leads to failure. Similar results ensue should the process of distillation be pushed too far.

The second prize of 50 guineas and the Association's silver medal have been awarded to Tarspra, Limited, 20, Victoria street, London, W., for their 700-gallon "Tarspra" (patent) Thornycroft motor van.



"Tarspra" Machine.

This machine is steam driven. Means are provided for hoisting barrels on to the machine either at the gas works or along the roadside. The tar can be heated to any temperature required, and it can be sprayed any width, from 1 foot 6 inches to 9 feet 6 inches. The tar can be spread evenly on the road at the rate of from 1 gallon to 5, 8, 10 or 16 square yards. The machine has been working during the whole of the present season in the county of Kent, and samples of work done by it can be seen in the main roads at Bromley, at Farnborough and other places. The Company have had in work during the season over 30 machines, and, as a result of the very extensive experience thus obtained, various improvements have been carried out since the competitions were held, and these will be embodied in the machines sent out in future.

For the best preparation of tar for road purpose the first prize of the Ballymena Woolen Factory Company's 100 guineas trophy and the Association's gold medal have been given to Messrs. R. S. Clare & Co., Ltd., Stanhope street, Liverpool, for "Clare's patent tar compo."

The tests in which the foregoing awards have been made were carried out on 22d, 23d, 24th and 27th May last on certain roads in Middlesex and Berkshire. Since these dates the roads have been kept under constant observation, and durability being an important consideration, it has not been possible to make the awards until the present time. A full report of the trials is now in course of preparation. It is proposed to divide it into two sections—one, the judges' report on the respective merits of the various machines and preparations of tar entered for the competitions, and the other a full and comprehensive survey of the whole question of the use of tar for road purposes.

The cost of these trials was borne by the Royal Automobile Club and the Motor Union of Great Britain and Ireland. The Judges Committee, in addition to members of the Council of the Roads Improvement Association and others, included eight leading engineers and road surveyors appointed after consultation with the Incorporated Society of Municipal and County Engineers and the County Surveyors' Society.

The Accuracy of Pressure Gauges.

Engineering says that the accuracy of a pressure gauge is a matter that has to be taken very much on trust by the ordinary user. Except for the periodical tests made by the boiler insurance company, he has no means of assuring himself that the indications of the pointer have any direct relationship with the boiler pressure. Of course, when a battery of boilers is supplying the same steam main, there is ground for doubting the reading of any gauge which does not agree with the majority; but in the case of an isolated boiler this check is absent. Then the imperative warning of the safety valve is the only hint that the pressure has passed its safe limits. So great, however, is the reliance often placed on gauges that their indications have even been accepted in preference to the evidence of the safety valve, and fatal accidents have resulted, as at Barking.

That the confidence in pressure gauges is, in general, justified, is ample shown by the results of tests of these instruments recently carried out on the suggestion of the Manchester Steam Users' Association, at the National Physical Laboratory. Unfortunately, the results are hardly so typical as they might be, because the gauges experimented on were not bought at random in the open market, but were those sent by makers specially for the purposes of test. Moreover, although 10 gauges were tested, they only represented the products of two firms, as other makers applied to did not comply with the request. Of the gauges submitted, eight were manufactured by Messrs. Schaffer and Budenberg, and two by Messrs. Dewrance. The Schaffer instruments comprised two standard 7-inch gauges, marked at 5-pound intervals up to 300-pound per square inch; two 7-inch gauges, marked every 5-pound up to 250-pound; two other 7-inch gauges, marked at every 5-pound up to 300-pound; and two 5-inch portable test-gauges, marked at 2-pound intervals up to 250-pound. The Dewrance gauges had both 7-inch dials, reading by 5 pound to 200-pound, one gauge having the rack, tube and hand all balanced, and both having solid drawn phosphor bronze Bourdon tubes, brazeless, and redrawn after bending. Two of the Schaffer instruments above mentioned had also solid drawn phosphor bronze tubes, the others being brazed.

The first test consisted in subjecting the gauges to the highest dial pressure for a few seconds and then checking the readings, both up and down the scale, at 20-pound intervals, up to a maximum pressure of 250-pound—the limit of the calibration of the standard mercury column. From the full records, which give the figures for 122 separate tests, there appears to be a fairly constant error of less than 1 pound per square inch at all pressures, the gauges reading higher than the true pressure by this amount. Thus what error there is is nearly always on the safe side, and when it is remembered that in many instruments the motion of the pointer is only $\frac{1}{16}$ of an inch per pound of pressure, the substantial accuracy of the readings is evident. In seven of the ten gauges the error is never on the wrong side; in one case the reading is $\frac{1}{16}$ of a pound low at 15-pound pressure; and the remaining two gauges share between them a dozen low readings, the worst of which is a reading of 150-pound when the real pressure is 150.35-pound. If we may assume, as is very probable, that the mercury column, against which most of these gauges were originally calibrated, gave scale readings corresponding to the pressure of mercury at 32° F., the temperature correction alone will result in the gauges having been marked high by about a quarter of 1 per cent., and this allowance will bring the average error considerably smaller even than it is already.

The second test was devised to detect any creepage of the reading after long continued pressure. The gauges were raised to their full dial reading, and the pressure maintained for 24 hours, but in no case could any appreciable difference be observed between the readings at the beginning and end of the experiment. The effect of temperature on the accuracy of the instruments was noted by running them in an electrically heated chamber, and comparing their readings, at a temperature of 150° F., with those of a standard gauge maintained at 65°

F., and also with their own records at this temperature. At a pressure of 10 pounds per square inch, the rise of the gauge reading, due to the higher temperature, varied from ½ pound per square inch to 1½ pounds per square inch. At the end of the scale, the error due to the temperature alone varied from 5 pounds to 6 pounds per square inch. It will be noted that the errors were again on the safe side, but they are certainly rather more than one would have expected. Probably few gauges work at a temperature of 150° F. in practice, but many certainly are in very warm situations, subjected to the radiations from a boiler front and the currents of hot air rising around them. The high reading of a hot gauge may have often been responsible for an apparently excessive pressure drop in a steam pipe, for the tests quoted show that a normal pressure drop of, say, 5 pounds from the boiler to the engine stop valve might appear as 10 pounds from the evidence of the gauges. An interchange of the gauges would, of course, make no difference, and undeserved blame might be cast on the steam pipe arrangement.

The effect of vibration of the gauges on the behavior of the pointers was tried by fixing the instruments to a horizontal slider moved rapidly to and fro by means of a crank. The gauges vibrated along the axes of the pressure connections, and the tests were made under various pressures. Before starting pressure was put on, and the gauge then disconnected from the supply, leaving the Bourdon tube completely filled with water at the desired pressure. The tests included vibrations of 1 inch, ¼ inch and $\frac{1}{16}$ inch, at 195, 340 and 725 revolutions per minute respectively. For the unbalanced gauges it was found that in all cases the maximum disturbance of the pointer occurred at the highest frequency of vibration. The oscillations of the pointers of the unbalanced gauges varied from 1 pound on the scale to as much as 32 pounds in one case, though at all pressures and frequencies and balanced gauge remained perfectly steady. A memorandum to the report, written by Mr. C. E. Stromeyer, the Chief Engineer to the Manchester Steam Users' Association, which we hope to give in full in a future issue, gives particulars of the balancing device adopted in the gauge in question, as well as many interesting notes on balancing and other matters connected with gauges. The oscillation of instrument pointers is a trouble that electrical engineers have long had to contend with, and they now have succeeded in making instruments dead-beat in a variety of ways. The conditions are not the same, as comparatively large forces are at play in steam gauges as compared with switchboard instruments, but it would be interesting to know whether the oscillations of a steam gauge could not be damped out instead of the forces being balanced. Magnetic damping is frictionless, very simple, and on certain instruments remarkably effective.

After the vibration tests the various gauges were tested for friction and backlash in the mechanism. The readings, taken with a slowly rising pressure, were compared with those taken with a slowly falling pressure, care being taken not to touch the instrument meanwhile. The difference between the readings was taken as the measure of the friction and backlash at the pressures indicated. The figures obtained show that in the worst case the total error due to friction and backlash never reached 1 pound on the scale. The mean readings of the instruments, moreover, closely agreed with the first readings taken, showing that the gauges had not been injured in any way by the heat and severe vibration tests they had undergone. The smallness of the effect of the intermediate tests is shown by a table in Mr. Stromeyer's report, to which we have referred. In this same report the author refers to the use of stops to limit the motion of the pointer or the Bourdon tube. The only legitimate use of a stop in any important instrument is to create an artificial zero. This is never needed in steam gauges for ordinary work, where a reading over the whole range of pressure is required. In the case of a gauge made specially to indicate a pressure of or about a given value with great accuracy, and where, therefore, a short open scale is desirable, it may be permissible to use a weak Bourdon tube and cut off the lower part of the scale by limiting the backward motion of the tube. In ordinary circumstances, however, there seems little to be said for the provision of any stops for either the tube or the pointer, even though their absence might be held to justify the veracious story of a boiler explosion, in which the fact that the gauge only read a few pounds pressure was accounted for by the statement of the attendant that it was going round for the second time.

Mr. E. E. Mandeville will hereafter act as Manager of the Eufaula (Ala.) Gas, Electric Light and Power Company.

What Is the Best Form of Power for Stations of 500 Kilowatts or Less?

In a paper contributed to the proceedings at the Toledo convention of the Ohio Electric Light Association, Prof. F. C. Caldwell stated that for small stations there are now available the following types of apparatus: Direct current, 2-wire, 220-volt, and 3-wire, 110-volt; also, alternating current, single phase or polyphase. The choice between these will depend, first, on the character of the load to be supplied; second, upon the size of the plant; and, third, upon the conditions under which it will be operated. A few years ago the 2-wire, 220-volt, direct current system seemed likely to take an important position for the smaller central station supply. Two factors, however, have recently been introduced into the problem, both of which are unfavorable to its growth. The first of these is the development of metallic filament incandescent lamps. The low resistivity of metals, as compared with carbons, makes the extension of these to voltages as high as 220 seem improbable, while the great saving in energy, resulting from their use, dare not be overlooked. The other factor is the placing on the market of successful 3-wire generators at a cost not greatly in excess of the standard type. The 220-volt system has never been much used in this country outside of the smallest plants, though its simplicity and comparative economy in distribution were strong arguments in its favor. It will doubtless continue to be employed in cases where transmission for power purposes is the main business; but where lighting is an important element it is probable that it has passed its period of greatest usefulness. The problem may, therefore, be narrowed down to a question of 3-wire direct current versus alternating current, single phase or polyphase.

As between the direct and alternating current, this question of distribution of load is the most important factor. Wherever more than one town is to be supplied with energy from the same plant, or where the character of the farming population is such as to make the sale of energy for lamps and motors among them a matter of importance, the decision must be in favor of alternating current. On the other hand, where the conditions seem to set definite and comparatively narrow limits to the area over which the plant will supply energy, the greater simplicity, higher economy in distribution and superior regulation usually obtained from direct current plants, may determine in favor of this form of supply. The amount and character of the motor load must be given careful consideration. If this is large in the immediate vicinity of the power plant, and especially if variable speed is important, the direct current will have the preference. If, on the other hand, the demand is more widely scattered, or is of such a nature that the simplicity and brushless character of the induction motor recommend themselves, the decision may be favorable to alternating current. The use of the storage battery in connection with the direct current system gives it an advantage: In some cases, for instance, it may be possible to supply direct current for 24 hours with the use of only 10 or 12-hour shift, at the same time obtaining the great advantages in the matter of regulation and storage against an emergency shut-down which are provided by the battery. Such a use of the battery, however, would only be possible in cases where the motor load is negligible, a condition which is in itself unfortunate. In general also the small plant is unable to supply the same quality of expert attention for the battery as is possible in larger stations, and this would often make its use questionable. In the case of very small stations, such as are now being installed to a considerable extent in the villages of the country, the use of an alternating current system with a frequency of 25 cycles should receive careful consideration. This would often be advantageous on account of the possibility, actual or prospective, of joining up such a plant with the 25-cycle distribution system of some interurban electric railway. Ample experience has demonstrated the satisfactory operation of incandescent lamps with 25-cycle current, and in almost every case it would be more economical to purchase energy from railway systems during a considerable part of the 24 hours rather than to keep the generating plant operating continuously. In many cases the whole output of the station could be most advantageously obtained in this manner. This suggests the supplying of energy from one plant to a number of small towns throughout a given district, a field which deserves more energetic cultivation than it has yet received.

The question of the use of single or polyphase alternating current is also an interesting one. Single phase motors are obtainable in small sizes, running up to about 30-horse power, so that where the supply of power in large units is not to be anticipated, as, for instance, in the case of a strictly farming community much is to be said in

favor of the greater simplicity of the single phase. Especially is this true in the case of the smaller plants where it is not practicable to employ a superintendent who has had much training or experience. In the case, however, of the larger plants within the range under consideration, especially if connection with an electric railway supply circuit is considered, the polyphase system should probably be used. With a little more care in distribution, just as good results can be obtained as with the single phase, and the possibility of the use of larger motors is always present.

With reference to prime movers, Prof. Caldwell made the following classifications: 1. Water power; 2, gas power—natural gas, producer gas; 3, steam power—reciprocating engines, turbines.

With regard to water power, nothing need be said, further than to predict that before many years energy will be developed in Ohio by water power at a greater rate than is now done. It is a very interesting problem, but, of course, peculiar to special localities only.

Where natural gas is available, there is hardly room for any further discussion of this subject, so far is the gas engine thus operated superior to all other forms of heat engines. With a thermal efficiency approximately double that of reciprocating steam engines, with the entire absence of loss when the engine is not running and with the great rapidity with which it can be brought into operation, no form of steam engine is to be compared with it for small plants. The complication and liability to accident and shut-down, which have been in the past attributed, with more or less justice, to the gas engine, have of late been rapidly losing weight by virtue of improvements in design and greater familiarity on the part of the engineers. In the case of small plants for lighting or power purposes, the defect of the gas engine in not having a considerable overload capacity is not so serious as in other lines, although it must be taken into account in the design of the plant.

In the absence of either water or natural gas, the producer and gas engine plant is in free competition with the various forms of steam engine, with a strong indication that the odds are coming to be more and more favorable to the former. Here success depends entirely upon the producer, which seems satisfactory in the case of the harder coals. In Ohio, however, the producer must demonstrate its ability to handle the bituminous coals of the State before it can be generally accepted as a substitute for the steam boiler. Its friends already claim the victory, and when account is taken of the relative time that has been spent in the development of the producer and the boiler, those who have been devoting themselves to the former certainly deserve congratulation. With a producer working successfully with soft coal, the steam engine will, indeed, have to look to its laurels, for the possibility of getting nearly twice as much energy from a ton of coal, together with the small standby losses and the quick service, give the gas engine enormous advantages against which the somewhat lower first cost and the long standing reputation of the steam plant cannot long prevail.

Steam is, however, still with us, and doubtless will be for some time to come. Thus far, the great development which the turbine has induced in the case of the larger stations, has not been much felt by the smaller. Although at present turbines in a variety of smaller sizes are available, their use does not show as great an advantage over the reciprocating engine as in the large sizes; generally speaking, also, in the case of the small station, economy of space is not so vital a matter as with the large city plant. On the other hand, the simplicity of the turbine should be a matter of even greater consequence, so that the question of relative first cost would probably be a determining factor in most cases. Of course, wherever condensing water is available in ample quantity, anything but the very smallest plant should be operated with compound condensing machines. The availability of condensing water would also be important in determining the use of turbines. The question concerning the use of artificial means for the cooling of condensing water is a financial one, and depends largely upon the price of coal, the cheapness of which in Ohio would seldom permit of the use of this system. Another factor which should always receive consideration and which may at times determine the character of the steam plant, is the sale of exhaust steam for heating purposes. The jacket cooling water in a gas engine plant may be similarly used.

In the case of small lighting and power plants, their combination with some other form of industrial activity should be given consideration. In many cases, a power plant may be made to pay if during the daytime the energy of the plant can be consumed in the operation of some productive industry. This works out especially well where the industry is of such character that a part at least of its machinery can be closed down an hour or two earlier during the winter months without seriously interfering with its success. A combined electric and pumping plant is a similar case. This is an especially desirable arrangement, if water storage is available, so that the pumps can be entirely shut down during the period of peak load. In this connection the electrically driven centrifugal pump which has recently come before the public ought to prove useful.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. H. W. Lawton, and some other prominent men of the named place, have organized the Citizens Gas Company, of Burlington, Wis., and they have retained Messrs. Maural & Co., of Chicago, to construct an up-to-date water gas plant, of 75,000 cubic feet initial daily capacity. The site has been selected, and it is proposed to go on with construction work without delay.

Some time ago we had occasion to mention the fact that Mr. L. T. Palmer, President and General Manager of the Niagara Light, Heat and Power Company, of Tonawanda, N. Y., had also been elected Vice-President of the Lawerance Stove and Manufacturing Company. There was some mixup as to the precise titles in the first mention, but the current ones are the correct ones.

The buildings of the Beaumont (Tex.) Gas Company that are now being constructed to replace those destroyed by fire last month are to be built of concrete blocks.

The annual meeting of the shareholders in the Woonsocket (R. I.) Gas Company will be held at 3 P.M. to-morrow.

The New York *Sun* maintains an interesting column that bears the heading, "Live Topics About Town." Last Tuesday the following paragraph was printed therein: "I'll tell you a secret," said the old campaigner, "that I've just discovered. If you want an old fashioned roasting ear that will make your mouth water and transport you back to your childhood days in the country, broil your ears of corn on your gas range. They taste exactly like the corn we roasted on a stick over the fire when I was a youngster on a farm in Iowa."

"J. D. T.," writing to the Journal under date of the 28th ult., informs us that Mr. Charles Stokes, who has been the representative of the Citizens Gas and Electric Company at Cedar Falls, Ia., for the past year or more, left there on August 20th for St. Charles, Mo., where he will take up the duties of representative for the St. Charles Lighting Company. The Friday evening prior to his departure he was tendered a banquet by the "Gas and Electric Study Club," which is composed of the Company's employees at Waterloo and Cedar Falls. Mr. Stokes is a Past-President of the Club. A very enjoyable evening was spent, and numerous short speeches were made. Of course, the talks of the evening were those by Mr. H. S. Maynard, Secretary of the Company, in wishing their guest Godspeed, and by the guest in response. Our correspondent did manage to "annex" the copy of Mr. Stokes' remarks, but was not successful respecting the lines of Mr. Maynard, which he regrets very much, as they were of the right and true sort. Mr. Stokes said: "It is with difficulty that I rise to-night to respond to the many kinds words and good wishes expressed by you all, either in so many words, or through the kind expressions on your faces, and I shall not attempt to adequately give vent to my feelings on an occasion like this. I have no words at my command which would properly voice the feelings that sway me to-night. Let it be sufficient for me to say to you all that with sorrow I shall part with you, because my stay with you has been one of continuous pleasure, good fellowship having ever been characteristic of our relations. Yes, indeed, a feeling of mutual brotherhood is the relation which I feel towards you all. No blur has ever on a single occasion come in our way of fellowship, and never have I met a more congenial set of men with whom to share our toils, from those in the highest places in the Company, to those in the so-called humblest places. In leaving you I feel that I shall ever miss your good fellowship, and away from here I shall ever look back to those months spent in your midst as having been amongst the brightest days of my life. Again thanking everyone of you for all your kindnesses in the past and for the hours of 'fest' here to-night, I wish you all an abundance of success in the future, and express the hope that our paths may often converge."

"R. R. T.," writing from Holland, Mich., under date of August 30th, said: "The employees of the Holland City Gas Company surprised their retiring Manager, Mr. E. M. Osbourne, the evening of August 28th, by assembling at his residence with well-furnished baskets. As a token of their esteem Manager Osbourne and his wife were presented with a beautiful silver service appropriately engraved.

Mr. Osbourne has been with the Company since 1905, and leaves its service to go ahead further in a business way, his resignation taking effect the 31st ult. He leaves this community with the good wishes of everyone."

MR. CHARLES E. CODDINGTON, prominent in the ownership of the Westchester Lighting Company, of Mount Vernon, N. Y., died at his country home in Bay Shore, L. I. He was a lawyer by profession, and was in his 55th year.

A CORRESPONDENT in San Jose, Cal., sends this, and we will put it out without comment: "Unknown to the authorities of Minneapolis a negro named Charles J. Chatten has been running a rooming house for negroes in the abandoned Hennepin County Jail; but the non-payment of rent to the county is not the reason why he changed his residence from the old jail to the new one. He was arrested, charged with stealing hundreds of dollars worth of gas from the Minneapolis Gas Light Company. Chatten says he came here a year ago, found the jail abandoned, and made a sleeping room of it. No one objected. Next he tapped the gas pipe and attached fixtures in the rooms which he rented to other negroes. As there were few windows in the building the lodgers were not stinted in their use of the illuminant, wherefore the consumption was enormous. I am unable to tell you how long he will remain in his present quarters."

AT a special meeting of the Paulsboro (N. J.) Council, held late last month, for the purpose of opening bids for the building of the proposed municipal gas plant at that point, the one submitted by Mr. Frank D. Moses was found to be the lowest. His figures were $29,600.

THE Public Service Commission, of New York, Second District, has authorized the Rockland Light and Power Company, of Nyack, Rockland county, to issue a 5 per cent., 30-year gold bond to the amount of $500,000.

MR. ERNEST CAREY has resigned from the service of the Harrisburg (Pa.) division of the U. G. I. Company to accept a responsible position with the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md.

THE Bluefield Gas Company, of Bluefield, W. Va., has been incorporated by Messrs. R. T. Scott, R. M. Hudson, F. D. Moses, A. H. Land and J. F. Land. It is capitalized in $50,000.

THE decrease in net earnings for the last 10 months of the Buffalo (N. Y.) Gas Company—the shrinkage amounts to $21,398—is directly attributable to higher prices for coal, oil and taxes.

THE Philadelphia Company, from its Pittsburgh offices, have notified the residents that during the months of September and October house connections along its lines will be made free of charge.

MR. GEORGE D. ROPER, of Rockford, Ills., has offered to equip the new domestic science room in the Rockford high school with all necessary furnishings to give practical lessons in cooking by gas, and the offer has been accepted. The donation includes a large gas range for the use of the demonstratress, and a small hot plate and oven for each of the 20 working desks in the class. All the necessary connections and piping are also to be supplied by Mr. Roper.

THE Nashville (Tenn.) Gas Company seems to be awakening to the possibilities that have been in front of it for 20 years. Its people in any event are advertising in the newspapers that it has gas for sale, and is also calling attention to the fact that those about to rent or purchase dwelling houses should find out before such renting or purchasing that the apartments are piped for gas.

ADVICES from the Brooklyn district of New York city are to the effect that almost all the electric lighting lamps in the old Village of Union Course, and several other districts in Queens county, L. I., are to be removed by the Department of Water, Gas and Electricity, and lamps of the Welsbach type substituted therefor.

THE Gas and Coke Improvement Company, to engage in the manufacture and sale of coke, and to mine coal, iron, steel, etc., has been incorporated in New Jersey, by Messrs. W. T. Day, Jerome T. Congleton and A. F. Slingerland. It is capitalized in $250,000, and its main offices are in Newark, N. J.

THE "Tarvia" folks seem to have been "rudely shocked" when the bids for the tar treatment work for Shelton avenue, New Haven, Conn., were opened the other day. There were only two bidders—the B. D. Pierce, Jr., Company, of Bridgeport, and the New Haven Gas Light Company. The Pierce combination asked a rate of 23 cents per yard; the gas folks said 13 cents would satisfy them.

ACCORDING to the Cincinnati *Inquirer* of recent date an action to recover $77,617.80 from the Chatfield & Woods Company, and the Chatfield Manufacturing Company, for an alleged breach of contract and failure to liquidate two notes has been commenced in the Superior Court by the Cincinnati Gas and Electric Company and the Union Gas and Electric Company, its successor. The suit is upon a contract made between the Cincinnati Gas and Electric Company and the Chatfield & Woods Company, February 7, 1902, whereby the latter Company agreed to take the entire output of coal tar from the Gas Company for a period of 5 years, at a stipulated price. The Cincinnati Gas and Electric Company was succeeded by the Union Gas and Electric Company, while the Chatfield & Woods Company assigned its contract to the Chatfield Manufacturing Company. The plaintiffs, however, charge that the contract terminated on July 1 last, and that on this date the Gas Company had on hand 2,319,742 gallons of the coal tar, valued at $120,734.99, which the defendants refused to accept, and which the Gas Company was forced to sell at the best market price obtainable, which was 2⅝ cents per gallon, or $60,893.23, entailing a loss thereby of $59,841.76, for which amount the plaintiffs now sue. Two other causes of action in the suit are for notes given for the payment of tar received. The first of these is for $9,070.45, and was given May 1, 1906, for 4 months, while the second is a 90 days' note for $8,598.11, executed July 2, 1906. Both of these are alleged to be unpaid, and judgment is asked for the amounts, with interest, making the entire total sued for $77,617.80. Attorneys Outcalt & Hickenlooper filed the suits. Attorney Joseph W. O'Hara, who represents the Chatfield & Woods Company and the Chatfield Manufacturing Company, stated that the trouble arose over a construction of the contract, which the defendants claim expired long prior to the date of expiration claimed by the Gas Company. Being unable to settle the question, the courts were resorted to.

THE Directors of the Sodus (N. Y.) Gas and Electric Company have elected Dr. Albert E. Larkin, of Syracuse, N. Y., as its Treasurer. The Company's President, Mr. C.W. Mills, is arranging for important service extensions to the electric division of its enterprise.

MR. HENRY J. BLAKESLEE, of Syracuse, N. Y., has been appointed a member of the committee of 12 named by the Public Service Commission, State of New York, Second District, to frame rules and regulations for the testing of gas and electric meters. The other members of the committee are, T. R. Beal, Poughkeepsie; Arthur Williams, Yonkers; C. R. Huntley, Buffalo; Silas Taber, Moravia; L. E. Imlay, Niagara Falls; G. W. Cunningham, Elmira; F. B. H. Paine, Buffalo; J. O. Langdell, Albany; R. M. Searle, Rochester; Prof. Robb, Troy; J. M. Sheehan, Newburgh.

THE Standard Gas and Electric Company, of Raleigh, N. C., is making notable extensions to its main system.

THE Empire Gas Improvement and Construction Company informs us, through its President, Mr. A. M. Sutherland, that it has completed its contract engagements on the works at Morris, Ills., and at New Berne, N. C. The generating capacity of each is 200,000 cubic feet per day.

MESSRS. J. S. PACKARD & SON have begun work on the new spur channel from the main channel designed to give a suitable waterway to the new plant of the Providence (R. I.) Gas Company that is to be constructed at Sassafras Point.

THE new plant of the Danbury and Bethel (Conn.) Gas and Electric Lighting Company is completed.

THE Chattanooga (Tenn.) *Times*, in speaking of the installation of Welsbach lamps of the boulevard type on East Ninth street between Market street and Georgia avenue, said that that block is the best lighted one in the city. This corroborates that which the *News* said last week.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, SEPTEMBER 9, 1907.

The Market for Gas Securities.

Consolidated moved up a trifle last week, but the increase in quoted rates as to value is as 1 is to 50. The shares opened to-day (Friday) at 105 to 107. It may be that the short interest in this specialty (and a good block of it around 106 is still in the brush) will get a swift reminder that Consolidated really has a substantial value.

Brooklyn Union was only notable in the week for a 5-point advance in the asking price. Massachusetts common, at 50, and Peoples, of Chicago, look tremendously inviting. The inquiry for gas bonds continues.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 9.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies	*Capital.*	*Par.*	*Bid*	*Asked.*
Consolidated	$73,177,000	100	105½	107
Central Union Gas Co.—				
1st 5's, due 1372, J & J..	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1915, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	150	180
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000	1,000	80	90
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold 6's, 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J..	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	..	97	101
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	95	110
1st Con. 5's, due 1948, M. & N	15,000,000	..		102
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	95½	96
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	92	98
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,036,500	100	107½	103
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	103	103
Bonds, 5's	10,500,000	..	101	102½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104½
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies of Boston	25,000,000	100	50	50¼
Preferred	25,000,000	100	80	80¼
Montreal, Canada	2,000,000	100	216	218½
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	87½	88
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105½
San Francisco, Cal.	15,800,000	00	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	950,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	375	380
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600.000	40	200	..

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Estimates furnished for the erection of complete gas works or the extension and modernizing of old works. All work warranted. Both water gas and coal gas.
EMPIRE GAS IMPROVEMENT & CONSTRUCTION COMPANY,
1628-tf 49 Wall Street, New York.

Position Wanted.
A Capable Manager and Superintendent,
Now employed, desires a position as manager or superintendent of gas, or combined gas and electric plants, in city of 15,000 to 25,000 population. Successful record. Southern or Middle States location preferred.
Address, "P. T. A.,"
1641-tf Care this Journal.

Position Wanted
AS FOREMAN OF DISTRIBUTION,
By married man, 30 years old, 12 years' gas company experience Excellent references. Thoroughly up to date and familiar with distribution work. Can also look after new business department.
1683-2 Address, "D. N. B.," care this Journal

Position Wanted.
Competent Gas and Electric Light Manager
Is open for position in a town of 15,000 to 25,000 inhabitants. Best of references. Capable of managing all departments. Address,
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POSITION WANTED.
Successful gas and electric manager is open for position. Can furnish best of references.
Address, "EXPERIENCE,"
1675-tf Care this Journal

Position Wanted.
FIRST-CLASS METER REPAIRER
Seeks employment with gas company where good work is appreciated. Address, "BOX 139,"
1682-2 Care this Journal.

Position Wanted.
The advertiser, who is 40 years old, wishes to secure a position as superintendent of a small works, or assistant superintendent of a large one. In the business 22 years and understands all of its divisions. Is an expert in planning and placing a main system.
1683-1 Address, "G. G. W.," care this Journal.

Position Wanted.
Experienced man, 27, married, present assistant engineer important English gas company, tired of country where influence takes precedence over ability, wants engagement with company in the States. Modern English works' practice, good business capacity, contractors' works-trained draughtsman, engineering college graduate. Who needs me?
1683-2 Address, "ENERGY," care this Journal.

WANTED,
A Coal Gas Maker.
State experience and also give references.
Address, "CENTRAL NEW YORK,"
1683-1 Care this Journal.

STATION METER WANTED,
CAPACITY, FROM 4,000 TO 8,000 PER HOUR.
Give full information concerning condition, size of connections, make, appurtenances, date of delivery, etc.
Address, "CAPACITY,"
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GAS BOOKS WANTED.
My library of gas books and subjects akin thereto, and which I believe was the most complete in existence, was destroyed in the April 18, 1906, San Francisco disaster. In re-establishing this library, which will find an ultimate home with a gas association or educational institution, I am desirous of securing all available gas literature printed in the English language, including technical works, reports, pamphlets, etc., and will purchase such as I do not yet possess. Those having such works will accommodate me by sending a description thereof, stating condition of volume and net price desired, carriage included. L. P. LOWE,
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WANTED,
SECOND-HAND, 4-FOOT STATION METER.
State age, condition and lowest cash price.
Address, ST. CHARLES LIGHTING CO.,
1682-3 ST. CHARLES, MO.

FOR SALE,
MacKenzie Exhauster and Engine, Self-Contained.
Eight-inch connections. Good condition.
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NEW YORK AND QUEENS GAS CO.,
1683-1 FLUSHING, N. Y.

Practical Photometry,
By William Joseph Dibdin.
Price, ... $3.00.
FOR SALE BY
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42 Pine St., New York City.

GAS AND ELECTRIC PROPERTIES BOUGHT AND SOLD.
M. J. LOXLEY COMPANY,
Land Title Building, Philadelphia, Pa.
We have an Attractive Pennsylvania Property for Sale.

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Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS. • Detroit, Mich.

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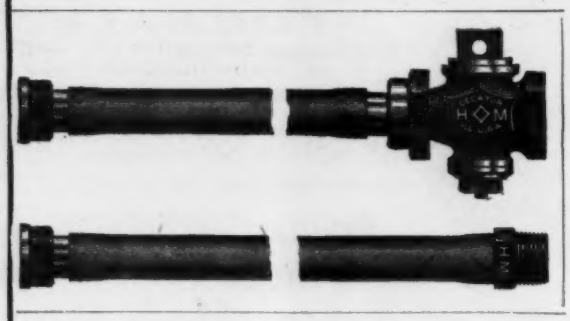
—AND SELL—
STAMFORD ODORLESS HEATERS,
ACKNOWLEDGED THE STANDARD.
MADE IN A NUMBER OF STYLES AND SIZES.
WRITE TO-DAY FOR OUR NEW HEATER CATALOG.
THE STAMFORD GAS STOVE CO.,
STAMFORD, CONN.

MUELLER GAS METER CONNECTIONS.

Sweat, Cup and Wiped Joint Meter Connections are made in 1,600 Styles and Specifications to meet the varying demands of gas works.

The same quality of material enters into the Three Patterns, each in its class being the best that experienced workmen and modern appliances can produce. You will never need but one set for a meter.



THEY WILL LAST FOR A LIFETIME.

The joints are perfectly made, connections are of good length and fittings are of Mueller Manufacture. Each Connection is rigidly inspected.

No Connection unfit for service is permitted to leave the Factory. All Goods Unconditionally Guaranteed.

Write for prices and literature.

H. MUELLER MFG. CO.,

Works and General Offices,
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NEW YORK, N. Y., U. S. A.
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Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, Paris, France.

ROTARY STATION METERS

Now in use in the United States and Europe

MEASURING A DAILY MAKE OF MORE THAN 300,000,000 CUBIC FEET.

400 Installations to date with capacities from 500,000 Cubic Feet per Hour down to 5,000 Cubic Feet per Hour.

30,000 cu. ft. per hour.	45,000 cu. ft. per hour.	60,000 cu. ft. per hour.
12-inch connections.	16-inch connections	20-inch connections.
40-inch face to face flanges.	52-inch face to face flanges.	58-inch face to face flanges.
50 inches floor to c. of dial.	61 inches floor to c. of dial.	70 inches floor to c. of dial.
FOR NORWICH, N. Y.	FOR EL PASO, TEXAS.	FOR CHESTER, PA.

The above engraving was reproduced from a photograph taken recently when these three meters were on the floor of our factory ready for shipment. Upwards of 50 Rotary Station Meters have at this date been installed or contracted for by gas companies located in 17 States of this country, and several in Canada.

ROTARY METER COMPANY

One-half the cost—One-tenth the space of old style wet meters.

When in need of Station Meters, write

ROTARY METER COMPANY,

280 Broadway, NEW YORK.

Send for Catalog.

P. PLANTINGA, President W. E. STEINWEDELL, Secretary

THE GAS MACHINERY CO.,

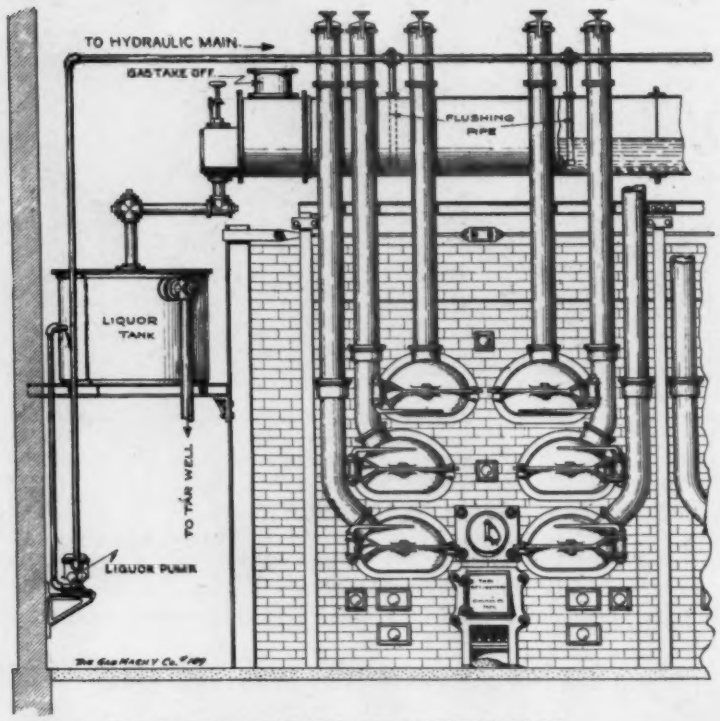
Main Office and Shops

CLEVELAND, OHIO.

NEW YORK OFFICE, - - 56 PINE STREET.

COAL AND WATER GAS APPARATUS,
EXHAUSTERS, CONDENSERS, SCRUBBERS,
TAR EXTRACTORS, WASHERS, PURIFIERS,
VALVES, CONNECTIONS,
BY PRODUCT MACHINERY,
COMPLETE GAS PLANTS.

PACIFIC COAST AGENTS: Hallidie Machinery Co., Seattle, Wash.



FLUSHING APPARATUS FOR HYDRAULIC MAINS.

THE GAS MACHINERY CO.
CLEVELAND, OHIO.

LACLEDE-CHRISTY CLAY PRODUCTS CO.,

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MANCHESTER AND
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ST. LOUIS, MO.

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LACLEDE FIREBRICK MFG. CO. and CHRISTY FIRECLAY CO.

ENGINEERS AND BUILDERS OF GAS BENCHES AND GLASS PLANTS.

OUR OWN DESIGNS INCORPORATED IN OUR BENCHES OF HORIZONTAL, INCLINED AND VERTICAL RETORTS.

SPECIAL DESIGNS FOR GLASS FURNACES TO SUIT SPECIAL CONDITIONS.

LININGS FOR

**LIME KILNS AND CUPOLAS,
REFUSE BURNERS, BRASS FURNACES,
WATER GAS SETS, HEATING FURNACES,
BAUXITE OR BASIC HOT ZONES,
ROTARY CEMENT KILNS.**

LOCOMOTIVE TILE,
BOILER SETTINGS,
TANK FURNACE BLOCKS,
SEWER PIPE AND FITTINGS,
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GLASS HOUSE REFRACTORIES,
FLUE LININGS, CHIMNEY TOPS,
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CLAY PRODUCTS OF EVERY DESCRIPTION.

Bray's Union-Jet.

THOSE WHO KNOW RECOMMEND BRAY BURNERS.

Take up most any publication devoted to Gas, read any book which deals with Gas, or look over the papers as read before the various Associations, and you will find that **BRAY BURNERS are always mentioned as the standard. The leading experts recognize and always quote them as such.**

Prof. VERNON HARCOURT, M.A., F.R.S. (Gas Referee to Board of Trade),

in a Lecture on **"IMPROVEMENTS IN GAS ILLUMINATION,"** before the Society of Arts, said the tables of tests which Mr. Harcourt had specially conducted to illustrate his lecture, showed that **BRAY'S FLAT-FLAME BURNER,** ungoverned, **yielded more light per cubic foot** of gas consumed than **any other Flat-flame Burner,** or cluster of Flat flame Burners, reported upon, and 6 per cent. more light than the Standard London Argand.

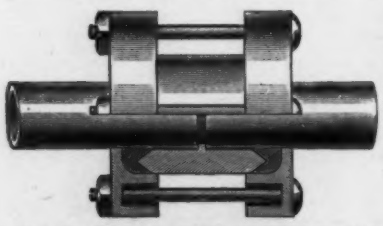
MAY WE SEND YOU OUR BLUE BOOK?

W. M. CRANE COMPANY,

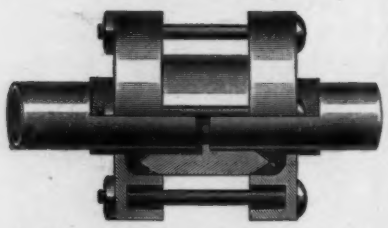
1131-33 Broadway, New York, N. Y.,

WE MAKE GAS APPLIANCES OF ALL KINDS. Sole Agents for Bray Burners for the United States and Canada.

Self-Lighting Burner.



Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



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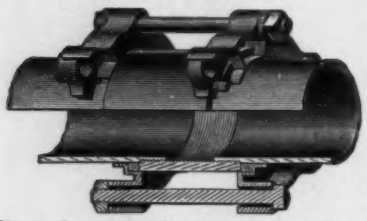

Clamp, Style 4, for Repairing Leaks on Screw Collar.

Long Sleeve, Style 2, for Mending Broken Lines.

S. R. DRESSER MANUFACTURING CO.,

SUCCESSORS TO

S. R. DRESSER,

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Patentee and Manufacturer of Specialties for Gas and Water Lines,

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

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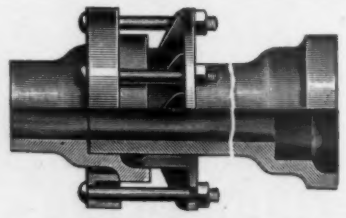
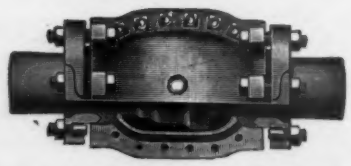
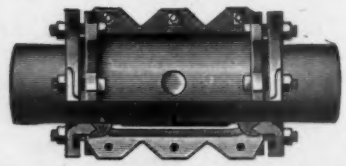


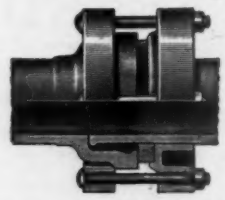
Coupling, Style 9, for Special Style Cast Iron Pipe.



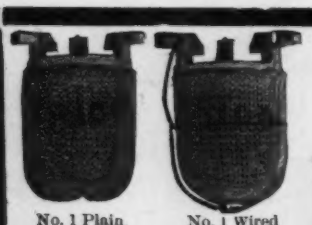
Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.



No. 1 Plain. No. 1 Wired.
For No. 1, 2, 4 and 5 Lamps.

Bijou. Bijou Wired.
For No. 3 (Bijou) Lamp.

"Rico" Mantles.

Ramsdell

Our Mantles are the Standard Inverted Mantles, just as the RAMSDELL is the Standard Inverted Lamp. They are manufactured especially for the Ramsdell Lamps, being made of double woven Ramie and bearing our Trade Mark "RICO." Being made on our patented Mantle Ring, a firm hold is obtained on the porcelain cone, which prevents the mantle being jarred off the holder. This is an important feature of the "Rico" Mantles, and is one of the points which makes them the best mantles produced.

We have the exclusive control for the United States and Canada of the Farkas patents, covering the WIRE CAGED MANTLES such as are used abroad for Railway Car Lighting. This Mantle has been extensively used by us in the past two years on the Ramsdell Inverted Arcs and on other lamps where they are subjected to unusually severe requirements.

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NO DUMPING OF METERS TO GET THE WATER OUT.

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They should be used in every home, no matter whether there are other hot water arrangements or not. ∴ ∴ ∴ ∴ ∴ ∴ ∴

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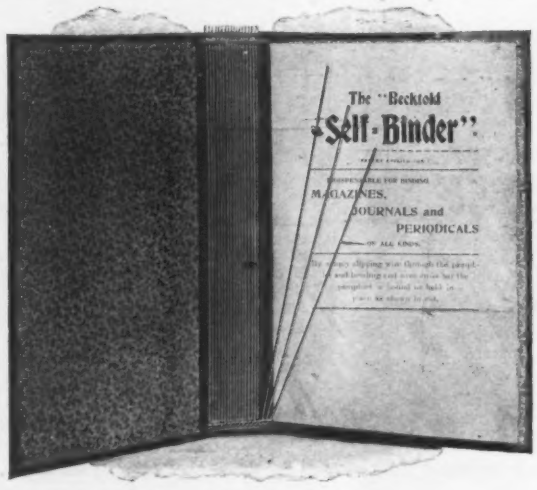

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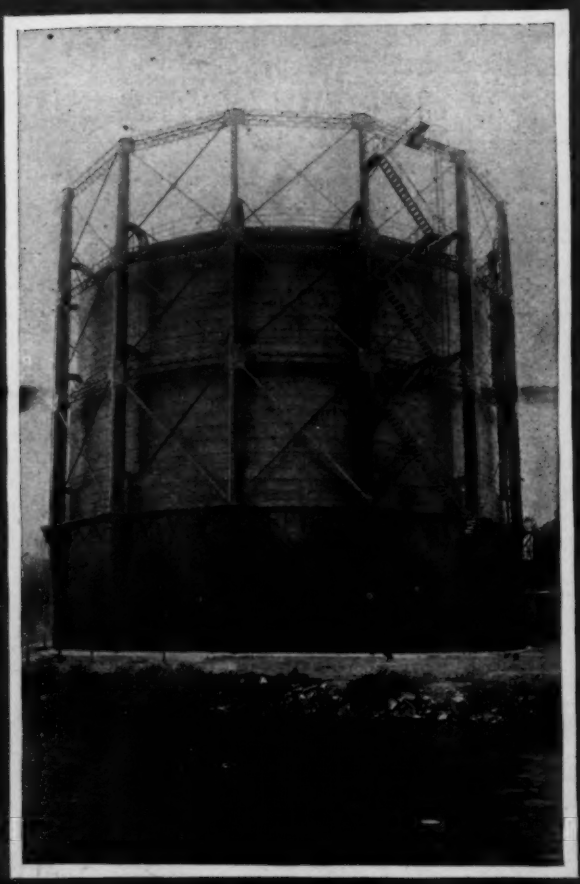

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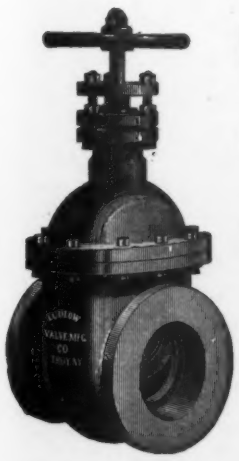

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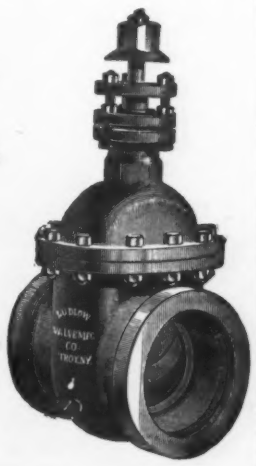

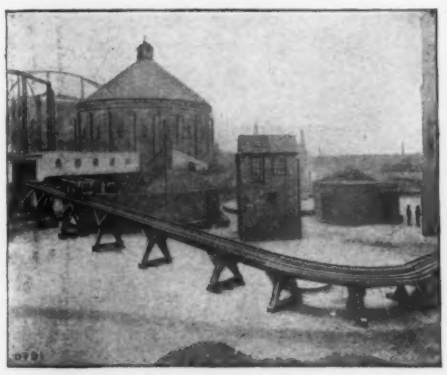

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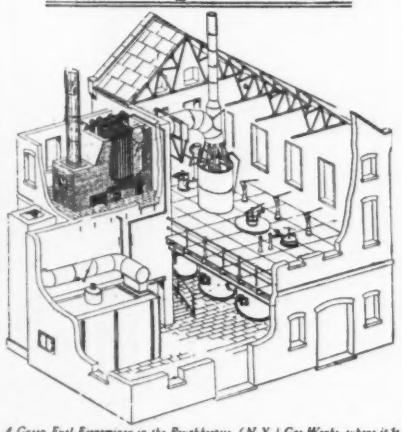
How to Save 15% of the Coal in Making Water Gas



A Green Fuel Economizer in the Poughkeepsie, (N. Y.) Gas Works, where it is Saving 25% of the Boiler Fuel. The Green Air Heater is Installed in the Same Manner as the Economizer and will save 15% of the Generator Coal.

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Also Builders of Fans, Blowers and Exhausters

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The stack valve gases from a gas generator usually escape at from 1,500° to 1,800° F. After passing them through the Green Air Heater to heat the blast they will still have a temperature of 800° F., which is higher than the usual temperature of flue gases from boilers. They may, therefore, still be used to heat water for the boiler, and will thus save 20 per cent. of the boiler coal. On this basis, a plant making 5,000,000 cubic feet of gas per month will save nearly $2,500 per year on a total investment of $3,500.

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REYNOLDS' GAS REGULATOR COMPANY,

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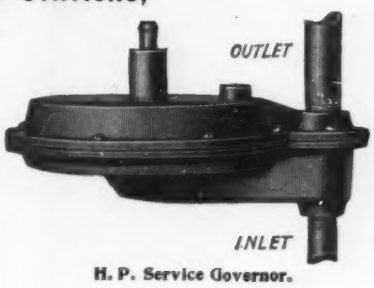

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Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

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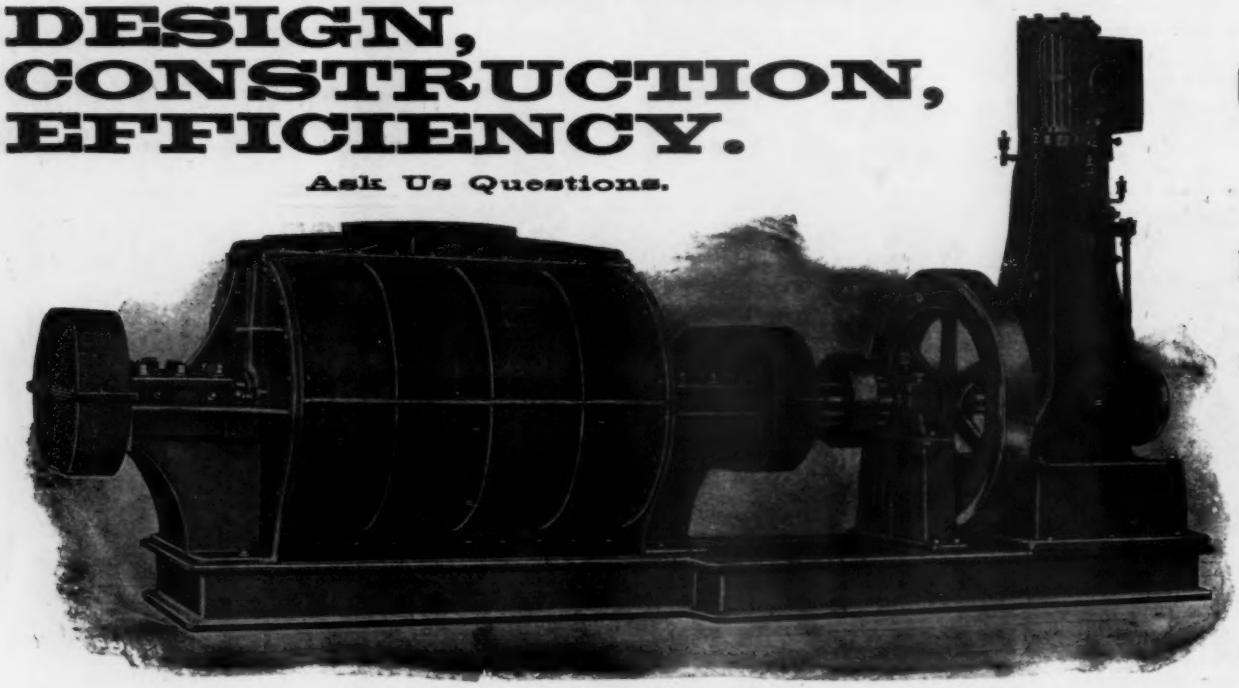

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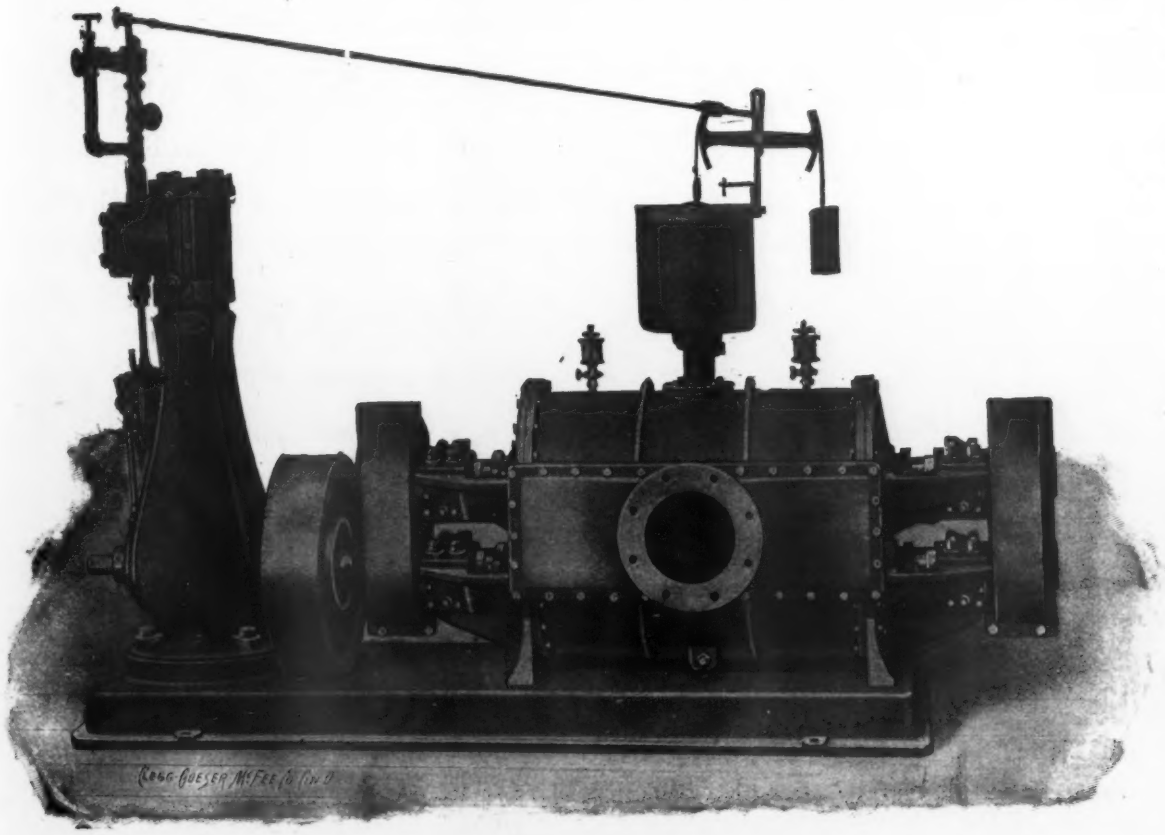

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Most perfect and sensitive Governor.

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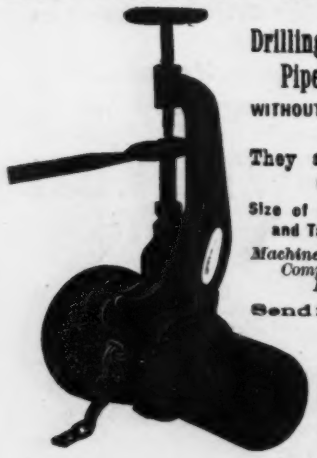

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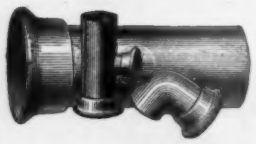

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WATER, GAS, DRAINAGE.

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Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

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Can be Used for so Many Purposes it would Take a Book to Name them. . . .

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With Instructions for Care and Working of the Same,

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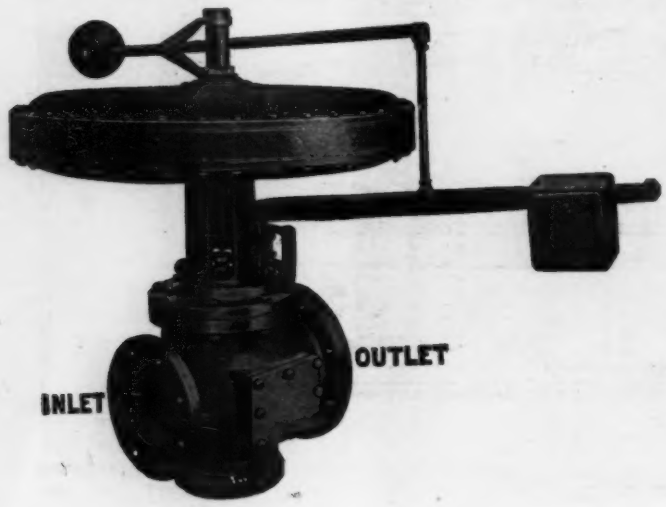

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For Artificial or Natural Gas.
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Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

Absolutely safe and reliable. No complicated mechanism to get out of order. More than 20 years' experience with the largest gas companies.

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

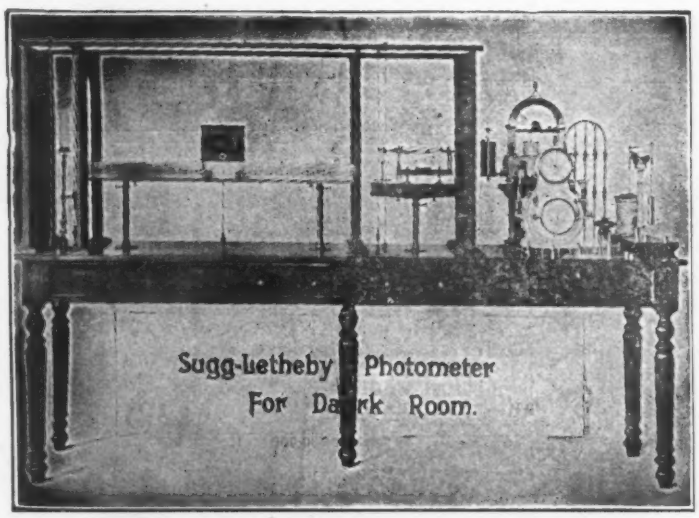
SEPTEMBER, 1907.

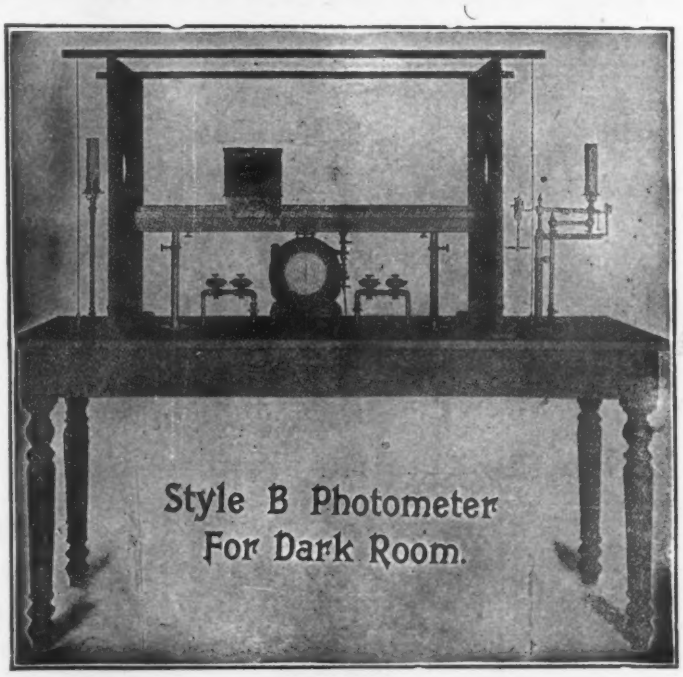
Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Sun.	1	7.00 PM	1.20 AM
Mon.	2	7.00	2.10
Tue.	3	7.00	3.10
Wed.	4	7.00	4.30
Thu.	5	7.00	4.30
Fri.	6	7.00	4.30
Sat.	7	7.00 NM	4.30
Sun	8	6.50	4.40
Mon.	9	6.50	4.40
Tue.	10	6.50	4.40
Wed.	11	6.50	4.40
Thu.	12	8.10	4.40
Fri.	13	8.50	4.40
Sat.	14	9.40 FQ	4.40
Sun.	15	10.30	4.40
Mon.	16	11.30	4.40
Tue.	17	12.30 AM	4.40
Wed.	18	1.50	4.40
Thu.	19	3.00	4.40
Fri.	20	No L.	No L.
Sat.	21	No L. FM	No L.
Sun.	22	No L.	No L.
Mon.	23	6.20 PM	8.20 PM
Tue.	24	6.20	8.50
Wed.	25	6.20	9.20
Thu.	26	6.20	10.00
Fri.	27	6.20	10.40
Sat.	28	6.20 LQ	11.20
Sun.	29	6.10	12.00
Mon	30	6.10	1.00 AM

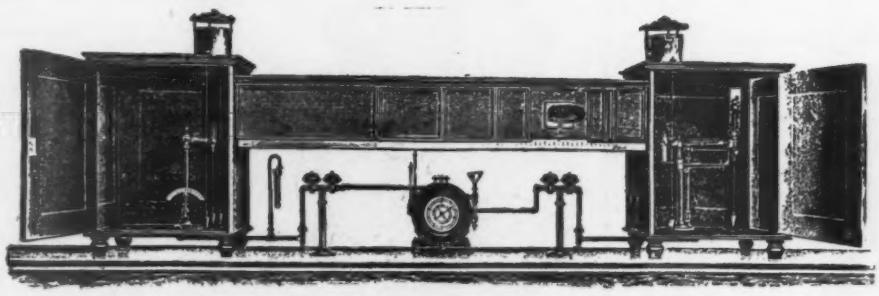
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1907.

Day of Week.	Table No. 2. NEW YORK CITY. All Night Lighting. Date.	Light.	Extinguish.
		P. M.	A. M.
Sun.	1	6.30	4.20
Mon.	2	6.30	4.20
Tue.	3	6.15	4.30
Wed.	4	6.15	4.30
Thu.	5	6.15	4.30
Fri.	6	6.15	4.30
Sat.	7	6.15	4.30
Sun.	8	6.15	4.30
Mon.	9	6.15	4.30
Tue.	10	6.05	4.40
Wed.	11	6.05	4.40
Thu.	12	6.05	4.40
Fri.	13	6.05	4.40
Sat.	14	6.05	4.40
Sun.	15	6.05	4.40
Mon.	16	6.05	4.40
Tue.	17	5.55	4.50
Wed.	18	5.55	4.50
Thu.	19	5.55	4.50
Fri.	20	5.55	4.50
Sat.	21	5.55	4.50
Sun.	22	5.55	4.50
Mon.	23	5.55	4.50
Tue.	24	5.40	5.00
Wed.	25	5.40	5.00
Thu.	26	5.40	5.00
Fri.	27	5.40	5.00
Sat.	28	5.40	5.00
Sun.	29	5.40	5.00
Mon.	30	5.40	5.00

TOTAL HOURS DURING 1907.

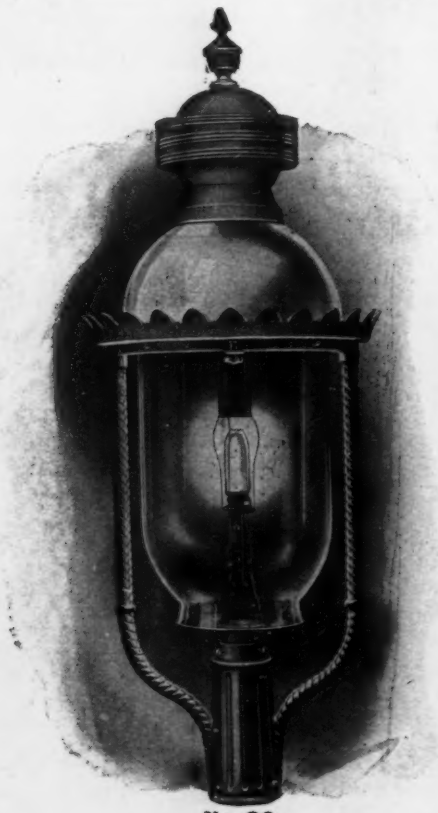
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



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Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

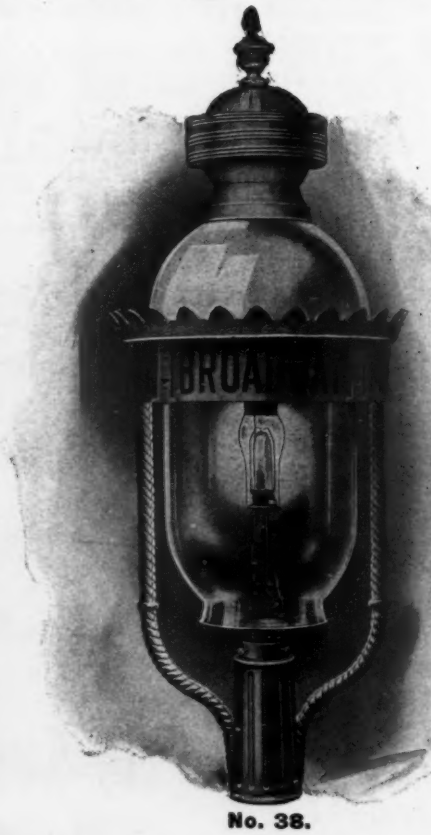
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



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THE BURNER.

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
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Will Not Discolor Ceilings.

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Extra Strong and Durable.
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Rich Mellow Light.

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Highest Quality Imported.
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Protection from the Falling of Heated Particles.
Increases Candle Power.

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LARGEST BUILDERS OF

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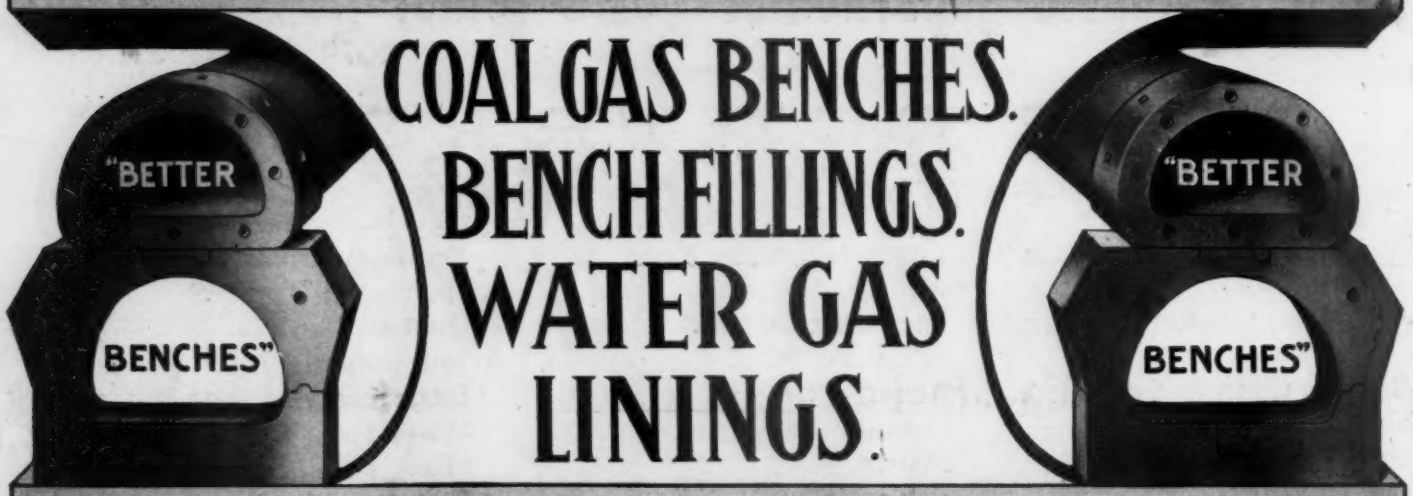

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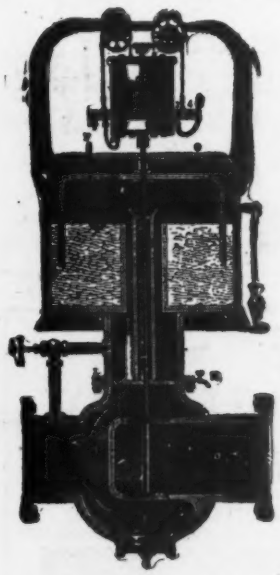

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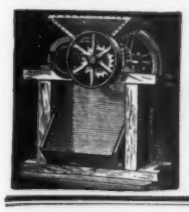

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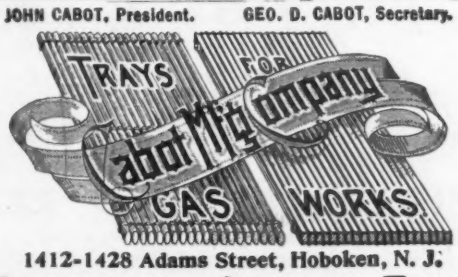

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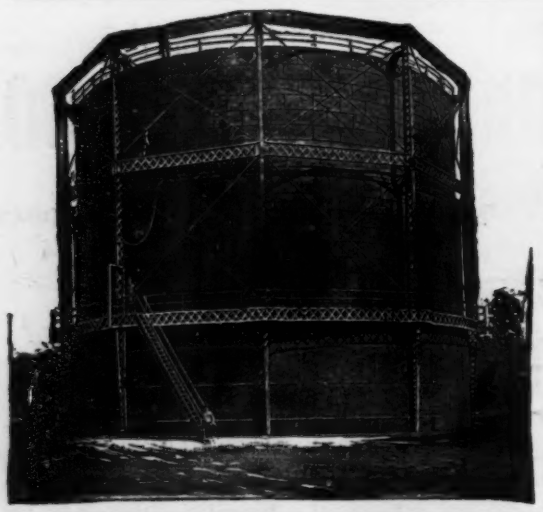

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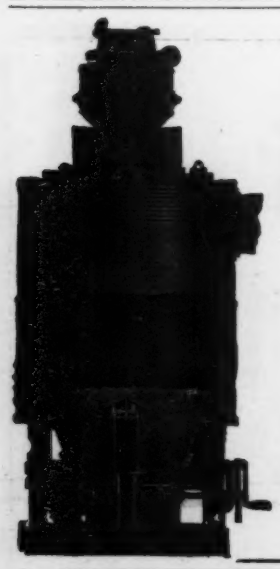

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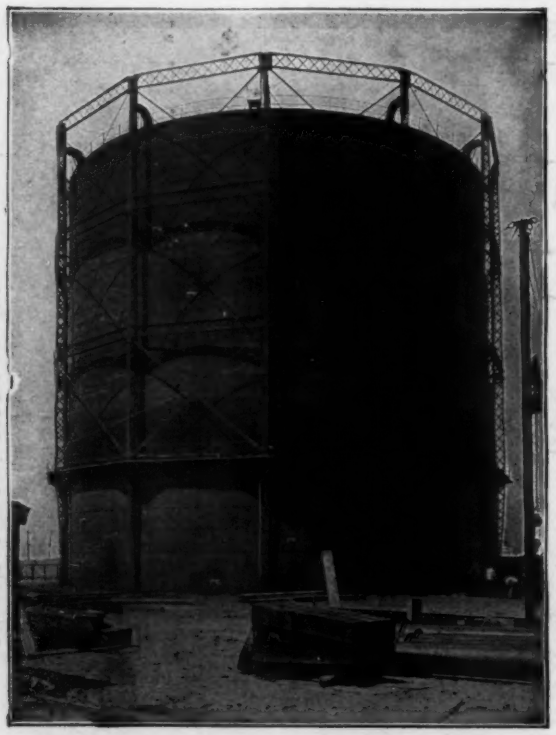

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